

INSTALLATION MANUAL FOR SEA TEL ST60-2 C-BAND CIRCULAR TVRO ANTENNA SYSTEM



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September 28, 2012

Document. No. 133656 Revision A1



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Sea Tel is an ISO 9001:2008 registered company.
Certificate Number 13690 issued March 14, 2011.

Revision History

REV	ECO#	Date	Description	By
X1	N/A	April 22, 2011	PRELIMINARY Release	MDN
A	N/A	September 14, 2011	Production Release	MDN
A1	N/A	September 28, 2012	Renamed ST60-2. Updated all text and drawings with model name change	MDN



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R&TTE Declaration of Conformity

Doc Number 122932 Revision F

Sea Tel Inc. declares under our sole responsibility that the products identified below are in conformity with the requirements of:

DIRECTIVE 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on Radio equipment and Telecommunication Terminal Equipment and the mutual recognition of their conformity.

Product Names: **3004 Ku Band TVRO Maritime Satellite Earth Station.**
 4004 Ku Band TVRO Maritime Satellite Earth Station.
 5004 Ku Band TVRO Maritime Satellite Earth Station.
 6009 C-Band TVRO Maritime Satellite Earth Station.
 6011 C/Ku Band TVRO Maritime Satellite Earth Station.
 ST88-21 C/Ku Band TVRO Maritime Satellite Earth Station.
 ST94-21 C/Ku Band TVRO Maritime Satellite Earth Station.
 ST144-21 C/Ku Band TVRO Maritime Satellite Earth Station.

These products have been assessed to Conformity Procedures, Annex IV, of the above Directive by application of the following standard(s):

EMC:


Marine Navigational and Radio Communication
Equipment and Systems – General Requirements: **IEC EN 60945:1997**

Safety:

Safety of information technology equipment: **IEC EN 60950-1:2001 (1st Edition)**

Certificates of Assessment were completed and are on file at NEMKO USA Inc, San Diego, CA and BACL Labs, Santa Clara, CA.

Sea Tel, Inc
Concord, CA


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Date

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1. 09 Series System Configuration(s)

The 09 Series Stabilized Antenna system is to be used for TeleVision Receive Only (TVRO) satellite communications, it is comprised of two major groups of equipment. These are the Above Decks Equipment (ADE) and the Below Decks Equipment (BDE). There will also be interconnecting cables between the ADE & BDE and cables to provide other inputs to the system.

1.1. *System Cables*

AC Power & Coaxial cables will be discussed in a separate chapter.

1.2. *Other Inputs to the System*

Multi-conductor cables from Ships Gyro Compass and Computer may also be connected in the system.

1.3. *Simplified block diagram of a Series ST60 system*

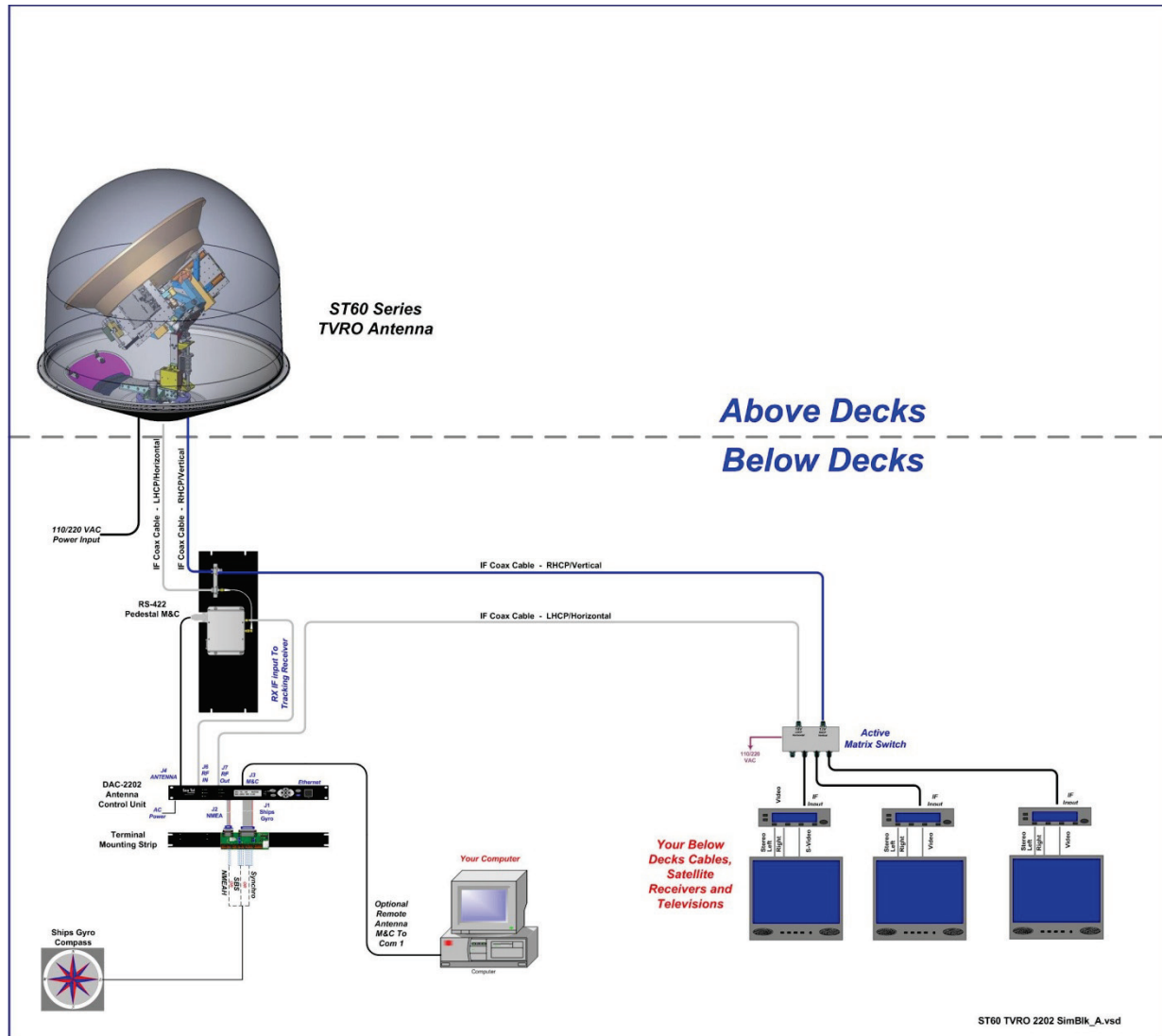
Your TVRO system consists of two major groups of equipment; an above-decks group and a below-decks group. Each group is comprised of, but is not limited to, the items listed below. All equipment comprising the Above Decks is incorporated inside the radome assembly and is integrated into a single operational entity. For inputs, this system requires only an unobstructed line-of-sight view to the satellite, Gyro Compass input and AC electrical power.

A. Above-Decks Equipment (all shown as the ADE) Group

- Stabilized antenna pedestal
- Antenna Reflector
- Dual Polarity Feed Assembly LNBS
- Radome Assembly

B. Below-Decks Equipment Group

- Antenna Control Unit
- Terminal Mounting Strip Assembly.
- Base Modem Panel
- Customer Furnished Equipment - Multi-switch, Satellite Receiver(s), Television(s) and other below decks equipment required for the desired TVRO system.
- Appropriate Coaxial and multi-conductor cables.



1.4. Dual Antenna Configuration

Sometimes, due to very large blockage conditions, you may need to install a dual antenna configuration to provide uninterrupted services. Two full antenna systems are installed and the ACU control outputs are connected to an arbitrator switch panel which then is connected to the below decks equipment. NOTE: The RXIF from EACH antenna MUST be connected to the RF IN (J6) on the rear panel of its respective ACU then RFOUT (J7) is connected to the RXIF input of the Dual Antenna Arbitrator. This connection scheme is required for ACU "A" to be able to control Antenna "A" (and ONLY Antenna "A") AND ACU "B" to be able to control Antenna "B" (and ONLY Antenna "B").

You will program the blockage zone(s) for each of the two antennas (refer to Setup – Blockage Zones). The blockage output from the ACU is fed to the Terminal Mounting Strip so that the output of each ACU can be connected to the arbitrator panel to control it. The blockage output is available on SW2 terminal of the Terminal Mounting Strip to provide a transistor "short" to ground when the antenna is within a blockage zone programmed into the ACU. When not blocked the SW2 terminal will be an "open".

When one antenna is blocked, its blockage output will command the arbitrator panel to switch services to the modem from that antenna to the other antenna. The arbitrator panel provides a logic latch to prevent excess switching when the ship heading is yawing, therefore, causing if the antenna to be repeatedly blocked – unblocked – blocked.

ST60-2 C-Band TVRO



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2. Site Survey

The objective of the Site survey is to find the best place to mount the antenna & the below decks equipment, the length and routing of the cables and any other items or materials that are required to install the system and identify any other issues that must be resolved before or during the installation. ***For Naval Engineering level information on this subject, please refer to Antenna Installation Guideline – Site Arrangement, document number 130040_A available on the Sea Tel Dealer Support Site.***

2.1. Site Selection Aboard Ship

The radome assembly should be installed at a location aboard ship where:

- The antenna has a clear line-of-sight to view as much of the sky (horizon to zenith at all bearings) as is practical.
- X-Band (3cm) Navigational Radars:
 - The ADE should be mounted more than 0.6 meters/2 feet from 2kW (24 km) radars
 - The ADE should be mounted more than 2 meters/8 feet from 10kW (72 km) radars
 - The ADE should be mounted more than 4 meters/12 feet from 160kW (250km) radars
- S-Band (10cm) Navigational Radars:
 - If the ADE is/has C-Band it should be mounted more than 4 meters/12 feet from the S-band Radar.
- The ADE should not be mounted on the same plane as the ship's Radar, so that it is not directly in the Radar beam path.
- The ADE should be mounted more than 2.5 meters/8 feet from any high power MF/HF antennas (<400W).
- The ADE should be mounted more than 4 meters/12 feet from any high power MF/HF antennas (1000W).
- The ADE should also be mounted more than 4 meters/12 feet from any short range (VHF/UHF) antennae.
- The ADE should be mounted more than 2.5 meters/8 feet away from any L-band satellite antenna.
- The ADE should be mounted more than 3 meters/10 feet away from any magnetic compass installations.
- The ADE should be mounted more than 2.5 meters/8 feet away from any GPS receiver antennae.
- Another consideration for any satellite antenna mounting is multi-path signals (reflection of the satellite signal off of nearby surfaces arriving out of phase with the direct signal from the satellite) to the antenna. This is particularly a problem for the onboard GPS, and/or the GPS based Satellite Compass.
- The Above Decks Equipment (ADE) and the Below Decks Equipment (BDE) should be positioned as close to one another as possible. This is necessary to reduce the losses associated with long cable runs.
- This mounting platform must also be robust enough to withstand the forces exerted by full rated wind load on the radome.
- The mounting location is robust enough that it will not flex or sway in ships motion and be sufficiently well re-enforced to prevent flex and vibration forces from being exerted on the antenna and radome.
- If the radome is to be mounted on a raised pedestal, it ***MUST*** have adequate size, wall thickness and gussets to prevent flexing or swaying in ships motion. In simple terms it must be robust.

If these conditions cannot be entirely satisfied, the site selection will inevitably be a “best” compromise between the various considerations.

2.2. Antenna Shadowing (Blockage) and RF Interference

At the transmission frequencies of C and Ku band satellite antenna systems, any substantial structures in the way of the beam path will cause significant degradation of the signal. Care should be taken to locate the ADE so that the ADE has direct line-of-sight with the satellite without any structures in the beam path through the full 360 degree ships turn. Wire rope stays, lifelines, small diameter handrails and other accessories may pass through the beam path in limited numbers; however, even these relatively insignificant shadows can produce measurable signal loss at these frequencies.

2.3. Mounting Foundation

2.3.1. Mounting on Deck or Deckhouse

While mounting the ADE on a mast is a common solution to elevate the ADE far enough above the various obstructions which create signal blockages, sometimes the best mounting position is on a deck or deckhouse top. These installations are inherently stiffer than a mast installation, if for no other reason than the design of the deck/deckhouse structure is prescribed by the ship's classification society. In the deck/deckhouse design rules, the minimum plating and stiffener guidelines are chosen to preclude high local vibration amplitudes.

Most installations onto a deck or deckhouse structure will require a mounting pedestal to raise the ADE above the deck for radome hatch access and to allow the full range of elevation (see ADE mounting considerations above). Some care must be taken to ensure the mounting pedestal is properly aligned with the stiffeners under the deck plating.

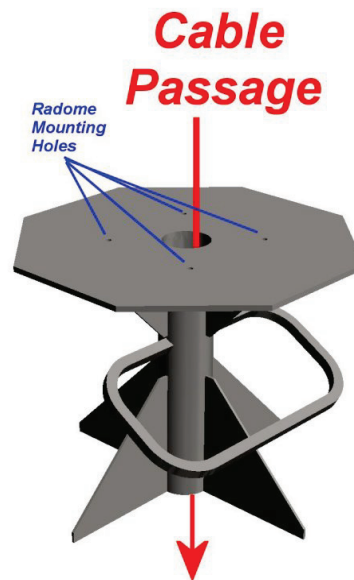
2.3.2. ADE Mounting Considerations

Mounting the radome directly on the deck, or platform prevents access to the hatch in the base of the radome unless an opening is designed into the mounting surface to allow such entry. If there is no access to the hatch the only way to service the antenna is to remove the radome top. Two people are required to take the top off of the radome without cracking or losing control of it, but even with two people a gust of wind may cause them to lose control and the radome top may be catastrophically damaged (see repair information in the radome specifications).

If access to the hatch cannot be provided in the mounting surface, provide a short ADE support pedestal to mount the ADE on which is tall enough to allow access into the radome via the hatch.

Ladder rungs must be provided on all mounting stanchions greater than 3-4 feet tall to allow footing for personnel safety when entering the hatch of the radome.

The recommended cable passage in the 50, 60 and 66 inch radomes is through the bottom center of the radome base, down through the ADE support pedestal, through the deck and into the interior of the ship.



2.3.3. Sizing of the support pedestal

The following should be taken into account when choosing the height of a mounting support stand:

1. The height of the pedestal should be kept as short as possible, taking into account recommendations given in other Sea Tel Guidelines.
2. The minimum height of the pedestal above a flat deck or platform to allow access into the radome for maintenance should be 0.6 meters (24 inches).
3. The connection of the ADE mounting plate to the stanchion and the connection of the pedestal to the ship should be properly braced with triangular gussets (see graphic above). Care should be taken to align the pedestal gussets to the ship's stiffeners as much as possible. Doublers or other reinforcing plates should be considered to distribute the forces when under-deck stiffeners are inadequate.
4. The diameter of the pedestal stanchion shall not be smaller than 100 millimeters (4 inches). Where the ADE base diameter exceeds 1.5 meters (60 inches), additional stanchions (quantity greater than 3) should be placed rather than a single large stanchion.
5. Shear and bending should be taken into account in sizing the ADE mounting plate and associated gussets.
6. Shear and bending must be taken into account when sizing the pedestal to ship connection.
7. All welding should be full penetration welds –V-groove welds with additional fillet welds – with throats equivalent to the thickness of the thinnest base material.
8. For an ADE mounted greater than 0.6 meters (24 inches) above the ship's structure, at least one (1)

foot rung should be added. Additional rungs should be added for every 0.3 meter (12 inches) of pedestal height above the ship's structure.

9. For an ADE mounted greater than 3 meters (9 feet) above the ship's structure, a fully enclosing cage should be included in way of the access ladder, starting 2.3 meters (7 feet) above the ship's structure.

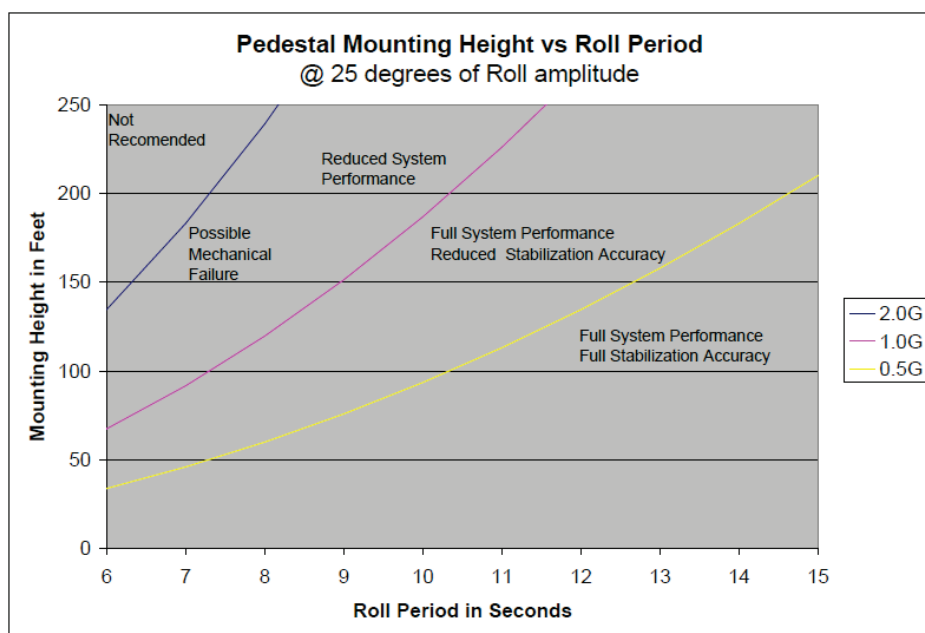
2.4. Mounting Height

The higher up you mount the antenna above the pivot point of the ship the higher the tangential acceleration (g-force) exerted on the antenna will be (see chart below).

When the g-force exerted on the antenna is light, antenna stabilization and overall performance will not be affected.

If the g-force exerted on the antenna is high enough ($> 1\text{ G}$), antenna stabilization and overall performance will be affected.

If the g-force exerted on the antenna is excessive (1-2 Gs), the antenna will not maintain stabilization and may even be physically damaged by the g-force.



2.5. Mast Configurations

Sea Tel recommends the ADE be mounted on the ship in a location which has both a clear line-of-sight to the target satellites in all potential azimuth/elevation ranges and sufficient support against vibration excitement. If possible, mounting the ADE pedestal directly to ship deckhouse structures or other box stiffened structures is preferred. However, in many cases, this imposes limits on the clear line-of-sight the antenna system has.

Often the solution for providing the full azimuth/elevation range the antenna needs is to mount the ADE on the ship's mast. Unfortunately, masts do not consider equipment masses in design and often have harmonic frequencies of their own.

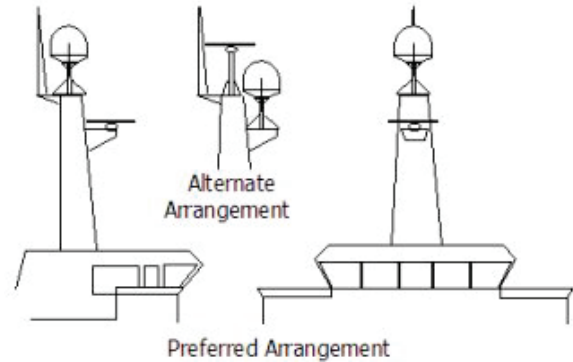
There are many designs of masts used on ships – masts are nearly as unique in design as the ship is – but the designs often fall into just a few categories. These categories can be addressed in terms of typical responses and problems with regards to vibration and mounting of ADE. The most common categories of masts are:

2.5.1. Vertical Masts

Vertical masts are a very ancient and common mast design. In essence, it is the mast derived from the sailing mast, adapted for mounting the ever-increasing array of antennae ships need to communicate with the world. This drawing of a Vertical mast shows preferred mounting of the ADE center-line above the plane of the radar, or as an alternate with the ADE mounted below the plane of the radar signal, as reasonably good installations of a satellite antenna ADE.

Vertical masts are most commonly still found on cargo ships – they are simple, inelegant and functional. They are also fairly stiff against torsional reaction and lateral vibrations, as long as the ADE is mounted on a stiff pedestal near the vertical centerline of the mast. If centerline mounting is impractical or otherwise prohibited, the mast platform the ADE is mounted on should be checked for torsional vibration about the centerline of the mast and the orthogonal centerline of the platform.

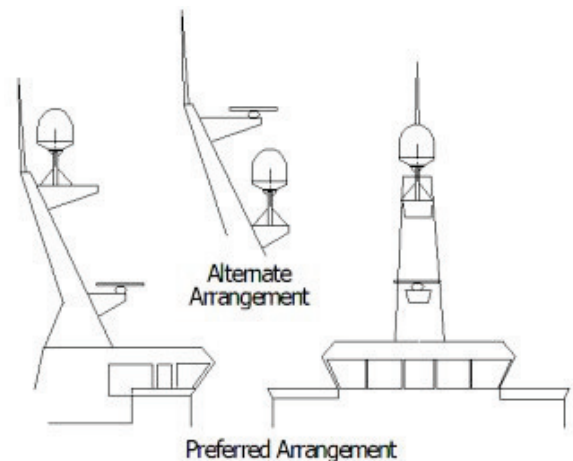
If the estimated natural frequency of the mast or platform is less than 35 Hertz, the mast or platform should be stiffened by the addition of deeper gussets under the platform or behind the mast.



2.5.2. Raked Masts

Raked masts are found on vessels where the style or appearance of the entire vessel is important. Again, the inclined mast is a direct descendant from the masts of sailing ships – as ship owners wanted their vessels to look more unique and less utilitarian, they 'raked' the masts aft to make the vessel appear capable of speed. This drawing shows a raked mast, again with the preferred ADE mounting above the radar and alternate with the ADE below the radar.

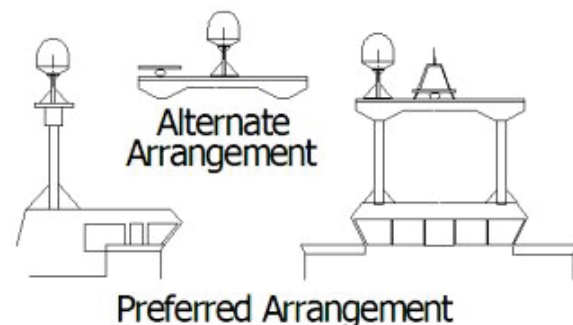
Raked masts pose special problems in both evaluating the mast for stiffness and mounting of antennae. As can be seen in the drawing all antennae must be mounted on platforms or other horizontal structures in order to maintain the vertical orientation of the antenna centerline. This implies a secondary member which has a different natural frequency than the raked mast natural frequency. In order to reduce the mass of these platforms, they tend to be less stiff than the main box structure of the raked mast. Thus, they will have lower natural frequencies than the raked mast itself. Unfortunately, the vibratory forces will act through the stiff structure of the raked mast and excite these lighter platforms, to the detriment of the antenna.



2.5.3. Girder Masts

Girder masts are large platforms atop a pair of columns. Just like girder constructions in buildings, they are relatively stiff athwart ship – in their primary axis – but less stiff longitudinally and torsionally. An example of a girder mast is shown in this drawing, with the preferred ADE mounting outboard and above the radar directly on one of the columns and alternate with the ADE centered on the girder above the plane of the radar.

The greatest weakness of girder masts is in torsion – where the girder beam twists about its vertical centerline axis. As with all mast designs discussed so far, mounting the antenna in line with the vertical



support structure will reduce the vibration tendencies. Mounting the antenna directly above the girder columns provides ample support to the antenna pedestal and locates the antenna weight where it will influence the natural frequency of the mast the least.

2.5.4. Truss Mast

Truss masts are a variant on the girder mast concept. Rather than a pair of columns supporting a girder beam, the construction is a framework of tubular members supporting a platform on which the antennae and other equipment is mounted. A typical truss mast is shown in this photograph.

Like a girder mast, truss masts are especially stiff in the athwart ship direction. Unlike a girder mast, the truss can be made to be nearly as stiff in the longitudinal direction. Truss masts are particularly difficult to estimate the natural frequency – since a correct modeling includes both the truss structure of the supports and the plate/diaphragm structure of the platform. In general, though, the following guidelines apply when determining the adequate support for mounting an antenna on a truss mast:

1. Antenna ADE pedestal gussets should align with platform stiffeners which are at least 200 millimeters in depth and 10 millimeters in thickness.
2. When possible, the antenna ADE pedestal column should align with a vertical truss support.
3. For every 100 Kilograms of ADE weight over 250 Kilograms, the depth of the platform stiffeners should be increased by 50 millimeters and thickness by 2 millimeters.

Sea Tel does not have a recommended arrangement for a truss mast – the variability of truss mast designs means that each installation needs to be evaluated separately.



2.6. **Safe Access to the ADE**

Safe access to the ADE should be provided. Provisions of the ship's Safety Management System with regard to men aloft should be reviewed and agreed with all personnel prior to the installation. Installations greater than 3 meters above the deck (or where the access starts at a deck less than 1 meter in width) without cages around the access ladder shall be provided with means to latch a safety harness to a fixed horizontal bar or ring.

The access hatch for the ADE shall be oriented aft, or inboard, when practical. In any case, the orientation of the ADE access hatch shall comply with the SMS guidelines onboard the ship. Nets and other safety rigging under the ADE during servicing should be rigged to catch falling tools, components or fasteners.

2.7. **Below Decks Equipment Location**

The Antenna Control Unit, Terminal Mounting Strip and Base Modem Panel are all standard 19" rack mount, therefore, preferred installation of these items would be in such a rack. The ACU mounts from the front of the rack. The Terminal Mounting Strip and Base Modem Panel mount on the rear of the rack.

The Satellite Modem, router, VIOP adapter(s), telephone equipment, fax machine, computers and any other associated equipment should also be properly mounted for shipboard use.

Plans to allow access to the rear of the ACU should be considered.

2.8. **Cables**

During the site survey, walk the path that the cables will be installed along. Pay particular attention to how cables will be installed all along the path, what obstacles will have to be routed around, difficulties that will be encountered and the overall length of the cables. The ADE should be installed using good electrical practice. Sea Tel recommends referring to IEC 60092-352 for specific guidance in choosing cables and installing cables onboard a ship. Within these guidelines, Sea Tel will provide some very general information regarding the electrical installation.

In general, all cables shall be protected from chaffing and secured to a cableway. Cable runs on open deck or down a mast shall be in metal conduit suitable for marine use. Cables passing through bulkheads or decks shall be routed through approved weather tight glands.

2.8.1. ADE/BDE Coaxial Cables

The first concern about the coaxial cables installed between the ADE & BDE is length. This length is used to determine the loss of the various possible coax, Heliac or fiber-optic cables that might be used. You should always provide the lowest loss cables to provide the strongest signal level into the satellite modem.

Signal cable shall be continuous from the connection within the ADE radome, through the structure of the ship to the BDE. Splices, adapters or dummy connections will degrade the signal level and are discouraged.

Be careful of sharp bends that kink and damage the cable. Use a proper tubing bender for Heliac bends.

Penetrations in watertight bulkheads are very expensive, single cable, welded penetrations that must be pressure tested.

Always use good quality connectors that are designed to fit properly on the cables you are using. Poor quality connectors have higher loss, can allow noise into the cable, are easily damaged or fail prematurely.

In as much as is possible, don't lay the coaxes on power cables. Try to have some separation from Inmarsat & GPS cables that are also passing L-band frequencies or Radar cables that may inject pulse repetition noise—as error bits - into your cables.

2.8.2. Antenna Power Cable

Be cautious of length of the run, for voltage loss issues, and assure that the gauge of the wires is adequate for the current that is expected to be drawn (plus margin). Antenna power is not required to be from a UPS (same one that supplies power to the below decks equipment), but it is recommended.

2.8.3. ACU Power Cable/outlet

The AC power for the ACU and other below decks equipment is not required to be from a UPS (same one that supplies power to the ADE), but it is recommended.

2.8.4. Gyro Compass Cable

Use good quality shielded cable (twisted pairs, individually foil wrapped, outer foil with braid overall is best) You only need 2-wire for NMEA signal, 4-wire for Step-By-Step and 5-wire for Synchro ... always use shielded cable. Be cautious of length and gauge of the run for voltage loss issues.

2.9. Grounding

All metal parts of the ADE shall be grounded to bare metal at the mounting pedestal. Grounding straps from the base of the ADE to a dedicated lug on the mounting pedestal are preferred, but grounding may also be accomplished by exposing bare metal under all mounting bolts prior to final tightening. Preservation of the bare metal should be done to prevent loss of ground.

Grounding should be ensured throughout the entire mounting to the hull. While it is presumed the deckhouse is permanently bonded and grounded to the hull, in cases where the deckhouse and hull are of different materials a check of an independent ground bonding strap should be made. Masts should be confirmed to be grounded to the deckhouse or hull.

3. Installation

Your antenna pedestal comes completely assembled in its radome. This section contains instructions for unpacking, final assembly and installation of the equipment. It is highly recommended that installation of the system be performed by trained technicians.


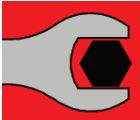
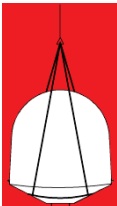

Your antenna may have been ordered in any one of a variety of different diameter radomes. The installation instructions for most common radome sizes for your system are below.

3.1. Unpacking and Inspection

Exercise caution when unpacking the equipment.

1. Unpack the crates. Carefully inspect the radome surface for evidence of shipping damage.
2. Unpack all the boxes.
3. Inspect everything to assure that all materials have been received and are in good condition.

3.2. Assembly Notes and Warnings

	<p>NOTE: All nuts and bolts should be assembled using the appropriate Loctite thread-locker product number for the thread size of the hardware.</p> <table><tr><th>Loctite #</th><th>Description</th></tr><tr><td>222</td><td>Low strength for small fasteners.</td></tr><tr><td>242</td><td>Medium strength</td></tr><tr><td>638</td><td>High strength for Motor Shafts & Sprockets.</td></tr><tr><td>2760</td><td>Permanent strength for up to 1" diameter fasteners.</td></tr><tr><td>290</td><td>Wicking, High strength for fasteners which are already assembled.</td></tr></table>	Loctite #	Description	222	Low strength for small fasteners.	242	Medium strength	638	High strength for Motor Shafts & Sprockets.	2760	Permanent strength for up to 1" diameter fasteners.	290	Wicking, High strength for fasteners which are already assembled.								
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	<p>WARNING: Assure that all nut & bolt assemblies are tightened according to the tightening torque values listed below:</p> <table><tr><th>SAE Bolt Size</th><th>Inch Pounds</th><th>Metric Bolt Size</th><th>Kg-cm</th></tr><tr><td>1/4-20</td><td>75</td><td>M6</td><td>75.3</td></tr><tr><td>5/16-18</td><td>132</td><td>M8</td><td>150</td></tr><tr><td>3/8-16</td><td>236</td><td>M10</td><td>270</td></tr><tr><td>1/2-13</td><td>517</td><td>M12</td><td>430</td></tr></table>	SAE Bolt Size	Inch Pounds	Metric Bolt Size	Kg-cm	1/4-20	75	M6	75.3	5/16-18	132	M8	150	3/8-16	236	M10	270	1/2-13	517	M12	430
SAE Bolt Size	Inch Pounds	Metric Bolt Size	Kg-cm																		
1/4-20	75	M6	75.3																		
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3/8-16	236	M10	270																		
1/2-13	517	M12	430																		
	<p>WARNING: Hoisting with other than a webbed four-part sling may result in catastrophic crushing of the radome. Refer to the specifications and drawings for the fully assembled weight of your model Antenna/Radome and assure that equipment used to lift/hoist this system is rated accordingly.</p>																				
	<p>CAUTION: The antenna/radome assembly is very light for its size and is subject to large swaying motions if hoisted under windy conditions. Always ensure that tag lines, attached to the radome base frame, are attended while the antenna assembly is being hoisted to its assigned location aboard ship.</p>																				

3.3. Installing the ADE

The antenna pedestal is shipped completely assembled in its radome. Please refer to the entire Site Survey chapter of this manual.

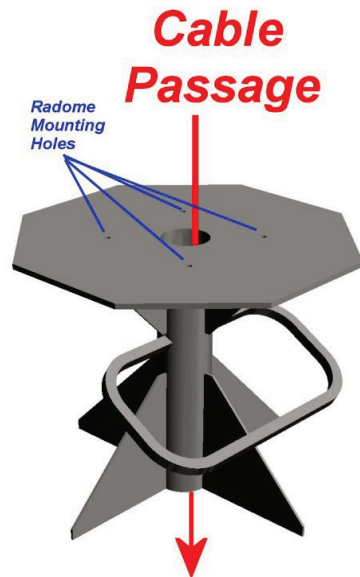
Base Hatch Access - Mounting the radome directly on the deck, or platform prevents access to the hatch in the base of the radome unless an opening is designed into the mounting surface to allow such entry. If there is no access to the hatch the only way to service the antenna is to remove the radome top. Two people are required to take the top off of the radome without cracking or losing control of it, but even with two people a gust of wind may cause them to lose control and the radome top may be catastrophically damaged (see repair information in the radome specifications) or lost.

If access to the hatch cannot be provided in the mounting surface, provide a short ADE mounting stanchion to mount the ADE on which is tall enough to allow access into the radome via the hatch.

Ladder rungs must be provided on all mounting stanchions greater than 3-4 feet tall to allow footing for personnel safety when entering the hatch of the radome.

Cable Passage - The radome base is designed with a bottom center cable passage and Roxtec® Multidiameter® blocks for cable strain relief. The recommended cable passage in the 50, 60 and 66 inch radomes is through the bottom center of the radome base, down through the ADE mounting stanchion, through the deck and into the interior of the ship.

Bottom center cable passage is recommended, however, a strain relief kit is provided with the system if off-center cable entry is required. **Note: Strain relief installation procedure, provided in the Drawings chapter, MUST be followed to assure that the cored holes are properly sealed to prevent moisture absorption and delamination of the radome base.**

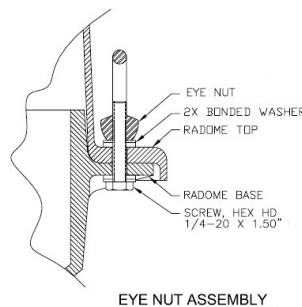


3.3.1. Prepare the 50", 60", 66" or 76" Radome Assembly

1. Remove the side walls of the Radome crate.
2. Lift the pallet using a forklift and/or jacks.
3. From the under side of the pallet, remove the 4 shipping bolts which attach the ADE to its' pallet. Discard this shipping hardware.



4. Remove four equally spaced bolts around the radome flange. Save these nuts and bolts to be re-installed later.
5. Install four lifting eyebolts in the vacant holes in the flange of the radome.. (Hardware provided in the radome installation kit). Keep the original perimeter bolt hardware to be re-installed after the ADE has been installed.



EYE NUT ASSEMBLY

6. Attach shackles and four part web lifting sling arrangement to the eyebolts.
7. Attach a suitable length tagline to one of the eyebolts.
8. After hoisted into place the lifting eyes are to be removed & replaced with the stainless hardware that was removed in step 4 (the eyes are galvanized with bare thread that will rust if left exposed to the weather).



3.3.2. Install 76" Radome to mounting deck.

The antenna pedestal is shipped completely assembled, restrained for shipping, in its radome.

1. Man the tag line(s).
2. Remove four equally spaced bolts around the radome flange. Save these nuts and bolts to be re-installed later.
3. Install four lifting eyebolts in the vacant holes in the flange of the radome.. (Hardware provided in the radome installation kit). Keep the original perimeter bolt hardware to be re-installed after the ADE has been installed.
4. Attach shackles and four part web lifting sling arrangement to the eyebolts.
5. Attach a suitable length tagline to one of the eyebolts.
6. Hoist the antenna assembly off the shipping pallet, by means of a suitably sized crane or derrick, to allow access to bottom of radome assembly.
7. Open the hatch by pressing the round release button in the center of the black latches and gently push the hatch up into the radome. Place the hatch door (gel coat surface up) inside the radome on the far side of the antenna pedestal.
8. Inspect the pedestal assembly and reflector for signs of shipping damage.
9. Remove the Clamp Bar and Rortex® Multidiameter® blocks from their mounting frame in the cable passage channel.
10. Peel the paper off of the mounting pad (provided in the radome installation kit) to expose the sticky side of the pad, align it to the mounting holes and press it in place on the underside of the radome base.
11. Using Loctite 271, install the 12 mounting bolts (provided in 123549-2 mounting kit) into the radome base. **ALL 12 mounting holes must be used when securing above decks equipment to vessel.**
12. Hoist the antenna assembly up onto the ship and hover above the mounting site on the ship.
13. Route AC Power, ground strap/cable (see Grounding info below) and IF coax cables through the cable passage in center of the bottom of the radome base and through the cable channel under the lower base plate of antenna. Allow enough service loop to terminate these cables to the circuit breaker assembly and connector bracket respectively (see cable termination information below).
14. Lower radome assembly into the mounting holes, positioned with the BOW reference of the radome parallel with centerline of the ship. Any variation from actual alignment can be compensated with the Home Flag Offset and AZIMUTH TRIM adjustment in the ACU, so precise alignment is not required.
15. Using Loctite 271, install the 12 fender washers and hex nuts (provided in mounting kit) from the underside of the mounting surface.
16. Remove the tag lines.
17. Remove the lifting sling.
18. Remove the 4 lifting eye nuts and re-install the original perimeter bolt hardware (the eyes are galvanized with bare thread that will rust if left exposed to the weather). Save the lifting eye hardware in case lifting of the ADE is required in the future.

3.4. Grounding the Pedestal

The antenna pedestal must be grounded to the hull of the ship. A grounding point is provided on the upper base plate to ground the pedestal. You must provide a cable, or strap, that is of sufficient gauge and length to ground the pedestal to the nearest grounding point of the hull (this is usually on or near the mounting surface).

Solid strap is the conductor of choice for low impedance RF ground connections because the RF currents tend to flow along the outer surface and the strap has a large, smooth, surface area to take full advantage of this effect.

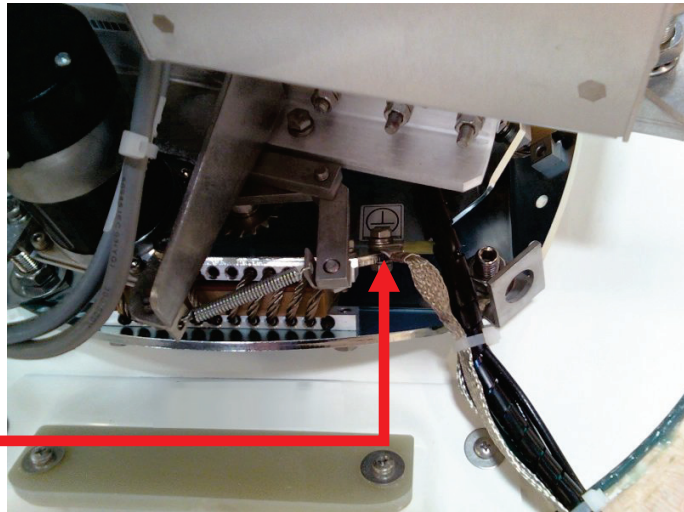
Braid is the conductor of choice where flexibility is required. Sea Tel uses braid to cross axes of the antenna pedestal and to connect various subassemblies together.

Wire is the easiest to install, the easiest to connect and is readily available with a weather protective jacket. 4 awg and 6 awg bare solid copper wire is commonly used as safety grounds and very basic lightning protection grounds. 2 awg stranded wire is often used for lightning grounding and bonding and it much more flexible.

1. Provide a grounding strap/cable (of adequate gauge for the length) to provide a good ground drain for the antenna pedestal. This cable/strap must also be insulated where it may be exposed to weather.

NOTE: Minimum gauge should not be smaller than **10 AWG**, even for a short cable run.

2. Route the ground cable/strap into the radome with the coax and power cables.
3. Connect grounding strap/cable to the burnished ground point on the upper base plate.
4. Route the ground strap/cable through one of the Roxtec® Multidiameter® blocks with the other power and coax cables.
5. Connect the other end of the grounding strap/cable to a burnished ground point on, or near, the mounting surface. Bi-metal coupling plate may be required to get good electrical coupling. Protective coating should be applied to prevent the grounding point from rusting or corroding.



3.5. Removing the Shipping/Stow Restraints PRIOR to Power-Up

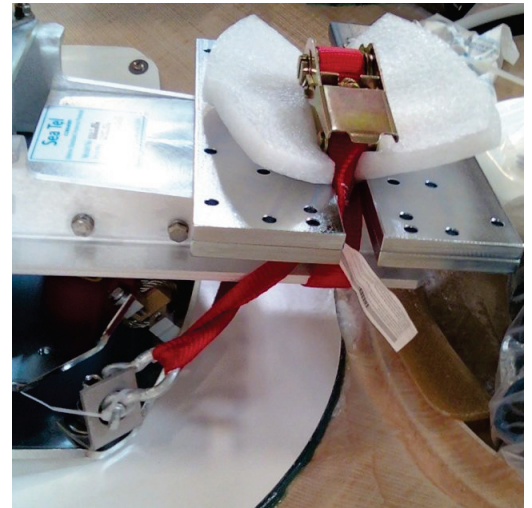
The order in which the restraints are removed is not critical.



CAUTION: There are three shipping/Stow restraints on this antenna pedestal that **MUST** be removed, **before energizing** the antenna, for normal operation.

3.5.1. Removing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To un-restrain azimuth rotation of the antenna simply untie/unbuckle the web strap and remove it from the azimuth post and clips.
3. Save the web strap so that the antenna can be restrained in the future should it be required.
4. Verify that the antenna rotates freely and easily a full 360 degrees CW & CCW in Azimuth.



3.5.2. Removing the EL Shipping/Stow Restraint

1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the stowed position the hardware from left to right is Stow pin-bolt head, washer, bracket, washer, hex nut, hex nut so that the pin section of the Stow pin-bolt is inserted into the hole in the elevation driven sprocket.

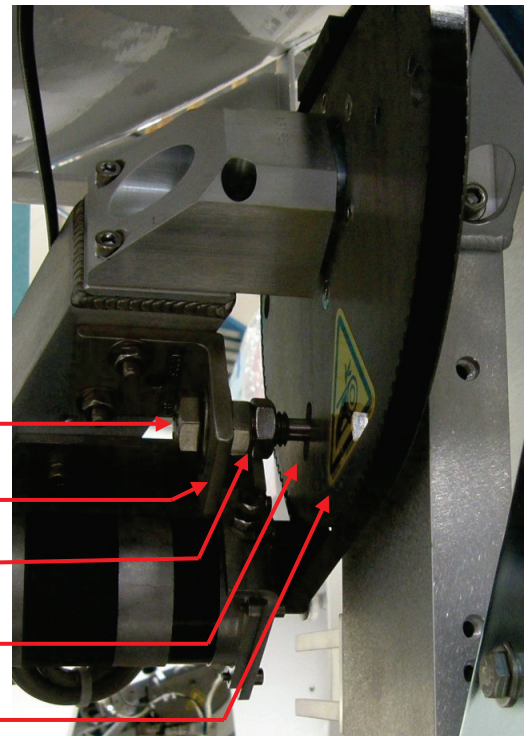
EL Stow Pin-Bolt head

Bracket

2 Hex Nuts

Pin inserted into Elevation Driven Sprocket

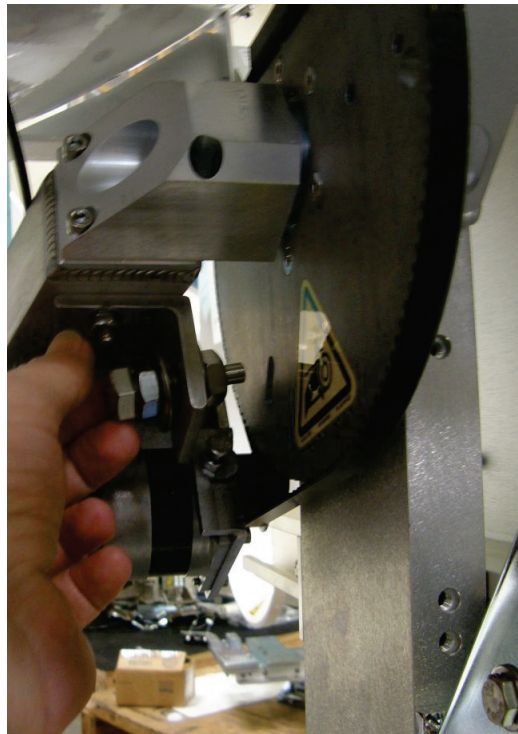
Elevation Driven Sprocket



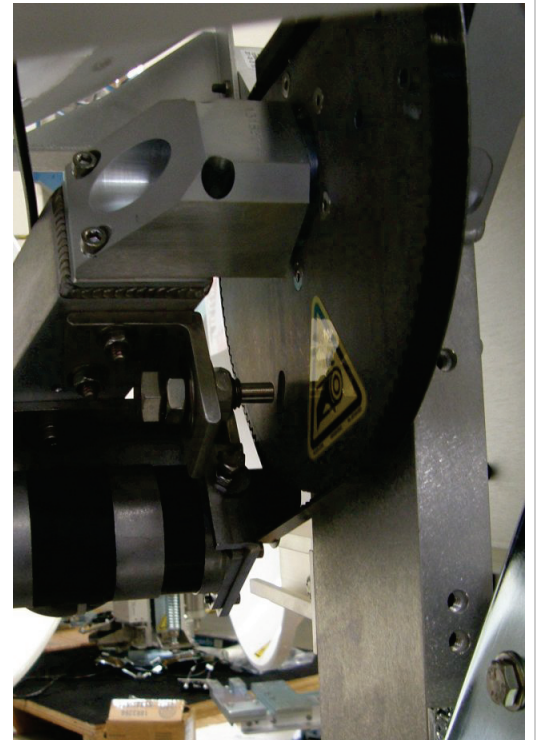
3. To un-restrain the elevation axis of the antenna, unthread the two hex nuts. Remove the hex nuts and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



5. Remove the washer from the stow pin-bolt and thread one of the 2 hex nuts onto the bolt and tighten.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then the other hex nut onto the bolt.



8. Tighten the hex nut to prevent the hardware from loosening while in the un-stowed configuration.
9. Verify that the antenna rotates freely through its full elevation range of motion.



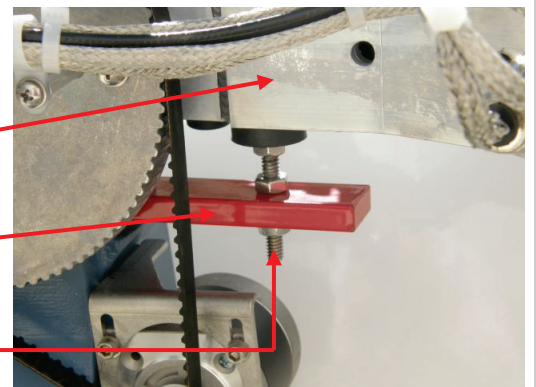
3.5.3. Removing the CL Shipping/Stow Restraint

1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place.

Cross-Level Beam

CL Shipping/Stow bar

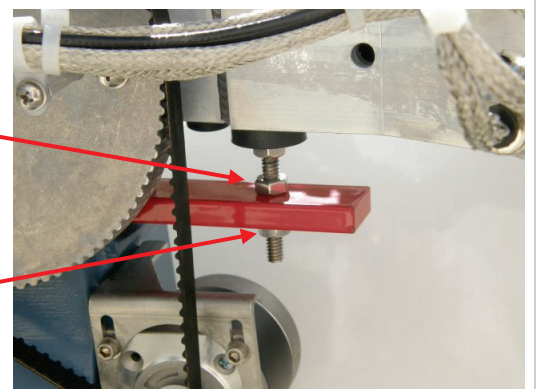
Adjustable CL Locking Bumpers (only one end shown)



2. To un-restrain the cross-level axis of the antenna use a 7/16" open end wrench to loosen the nut on the top side of the locking bar (either end of the bar).

3. Remove the bottom nut off of that adjustable bumper.

4. Remove the adjustable bumper from the locking bar.



- | | |
|---|--|
| <ol style="list-style-type: none"> 5. Extract the locking bar from the underside of the cross-level beam and retain these parts for later re-use if it becomes necessary to stow the antenna. 6. Verify that the antenna rotates (tilts left & right from level) freely through its full cross-level range of motion. | |
|---|--|

3.1. Cable Installation

3.1.1. Shipboard Cable Installation



CAUTION: Rough handling, tight bending, kinking, crushing and other careless handling of the cables and their connectors can cause severe damage.

The cables must be routed from the above-decks equipment mounting location through the deck and through various ship spaces to the vicinity of the below-decks equipment. When pulling the cables in place, avoid sharp bends, kinking, and the use of excessive force. After placement, seal the deck penetration glands and tie the cables securely in place all along the cable run(s).

3.1.2. C-Band ADE-BDE IF Cable Assignments

With the feed Polarity Select knob in **Normal** position:

The RHCP LNB output coax (yellow) is routed to the 400MHz modem "L-Band" connection on the PCU, then from the 400MHz modem "Rotary Joint" connection to the outer channel of the dual channel rotary joint, to the RHCP connection of the connector bracket mounted on the inside of the base of the radome. Your ADE-BDE IF signal cable which is mounted to this connector should be marked Normal-RHCP at both ends. Below Decks, this cable must be routed to the RF Input connection on the rear panel of the Antenna Control Unit (the RF output from the ACU will be routed to your satellite receiver or multi-switch).

The LHCP LNB output coax (black) is routed directly to the center channel of the dual channel rotary joint, to the LHCP connection of the connector bracket mounted on the inside of the base of the radome. Your ADE-BDE IF signal cable which is mounted to this connector should be marked Normal-LHCP at both ends. Below Decks, this cable, if used, would be routed to your satellite receiver or multi-switch.

If the feed Polarity Select knob is in the **Reverse** position these two ADE-BDE cables should be marked Reverse LHCP and Reverse RHCP respectively.

3.2. Installing the Below Decks Equipment.

Installing the Antenna Control Unit, Base Multiplexer Panel and the Terminal Mounting Strip.

3.2.1. General Cautions & Warnings



CAUTION - Electrical Shock Potentials exist on the Gyro Compass output lines. Assure that the Gyro Compass output is turned **OFF** when handling and connecting wiring to the Terminal Mounting Strip.



CAUTION - Allow only an authorized dealer to install or service the your Sea Tel System components. Unauthorized installation or service can be dangerous and may invalidate the warranty.

3.2.2. Preparing BDE Location

Prepare the Rack (or other location) for the ACU, Terminal Mounting Strip and base multiplexer panel. Prepare the mounting locations for the other Below Decks Equipment throughout ship.

3.2.3. Installing the Below Deck Equipment

1. Install the ACU in the front of the standard 19" equipment rack or other suitable location. The DAC-2202 ACU is one rack unit high.
2. Install the Terminal Mounting Strip on the rear of the 19" equipment rack or other suitable location that is within 6 feet of the rear panel connections of the ACU. It also is one rack unit height.
3. Install the Base Multiplexer Panel on the rear of the 19" equipment rack or other suitable location that is within 6 feet of the rear panel connections of the ACU. It is four rack unit height.
4. Install your Multi-Switch, Satellite Receivers, Television Sets, Computer and any other below decks equipment that are part of your installation.

3.3. Connecting the Below Decks Equipment

Connect this equipment as shown in the System Block Diagram.

3.3.1. Connecting the ADE AC Power Cable

Connect the AC Power cable that supplies power to the ADE to a suitably rated breaker or UPS.

3.3.2. Connecting the BDE AC Power Cables

Connect the AC Power cables that supply power to the Below Decks Equipment (ACU, Satellite Modem, phone, fax, computer and all other equipment) to an outlet strip fed from a suitably rated breaker or UPS.

3.3.3. Connecting the ADE-BDE IF Coaxes

At the connector bracket mounted on the Base Multiplexer Panel:

1. Attach the C-Band RHCP coax from the antenna to the connector on the Base Multiplexer Panel which is connected to the 400MHz Modem "RJ" input. Connect the 400MHz Modem "L-Band" output to the Vertical Low-band input of the CFE Multi-switch.
2. Attach the C-Band LHCP coax from the antenna to the connector on the Base Multiplexer Panel. Connect this connection from the Base Multiplexer Panel to the Horizontal Low-band input of the CFE Multi-switch.

3.3.4. Connect the Modem TXIF Coax

Connect the TXIF coax from the Base Multiplexer Panel to the Satellite Modem TX Output.

3.3.5. Antenna Control Unit Connections



Figure 1-1 Rear Panel DAC-2202 ACU

3.3.5.1. Antenna Control Serial Cable

Connected the Antenna Control Serial Cable from the Base Multiplexer to J4A on the DAC-2202.

3.3.5.2. ACU to Terminal Mounting Strip Connections

Connect the TMS to the ACU.

1. Connect the 25 pin ribbon cable from the Terminal Mounting Strip to J1 "Ships Gyro" DB25 on the rear panel of the ACU.
2. Connect the 9 pin ribbon cable (or NMEA serial cable) from the Terminal Mounting Strip to J2 "NMEA" DB9 on the rear panel of the ACU

3.3.5.3. RXIF Signal Input to the ACU

Connect the RXIF cable from the Base Multiplexer to the J6 "RF IN" connector on the rear of the ACU. This input provides satellite signal to the tracking receiver inside the Antenna Control Unit.

3.3.5.4. RXIF to the Multi Switch

Connect J7 "RF OUT" on the rear panel of the ACU to the RX Input connector on the Multi Switch. The RX signal level of the J7 output of the ACU is approximately unity with J6 input due to an internal amplifier.

3.3.5.5. M&C Connection to the ACU

If you wish to use a computer to Monitor & Control the antenna through the Antenna Control Unit there are two possible connections that can be made. One choice is a serial connection from J3 "M&C" connector on the rear panel of the ACU to a COM port on the computer using a serial extension cable. Another choice is to connect the "ETHERNET" connector on the rear panel of the ACU to a LAN connection on the computer or hub using an Ethernet crossover cable.

3.3.6. Terminal Mounting Strip (TMS) Connections

Connect the Ships Gyro Compass input to the appropriate screw terminals on this strip. There are several functional connections that may be made on the TMS connectors. Although you may not need to make all of these connections, they are listed here for clarification during the installation process. Connect the 9 pin ribbon cable from this PCB to J2 "NMEA" DB9 on the rear panel of the ACU. Connect the 25 pin ribbon cable from this PCB to J1 "Ship Gyro" DB25 on the rear panel of the ACU.



CAUTION - Electrical Shock Potentials exist on the Gyro Compass output lines. Assure that the Gyro Compass output is turned OFF when handling and connecting wiring to the Terminal Mounting Strip. DO NOT HOTPLUG THIS CONNECTION

3.3.6.1. TS2 Synchro Gyro Compass Input.

Use the R1, R2, S1, S2 and S3 screw terminals to connect the Synchro Gyro Compass to the ACU.

3.3.6.2. TS3 Step-By-Step (SBS) Gyrocompass Input.

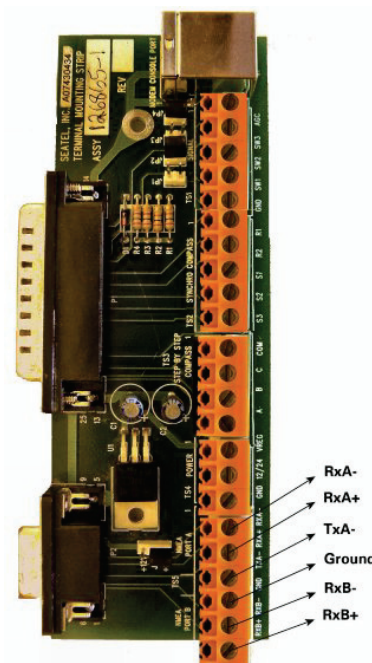
Use the COM, A, B and C screw terminals to connect the SBS Gyrocompass to the ACU. Some SBS Gyro distribution boxes have terminals which are labeled S1, S2 & S3 instead of A, B and C.

3.3.6.3. TS4 Power

- **VREG** Screw terminal is used to provide a regulated DC operating voltage to ancillary equipment. Voltage out is dependant upon which terminal mounting strip assembly is provided. 126865-1 supplies 8Vdc @ 1Amp, while the 126865-2 assembly supplies 5Vdc @ 2Amps.
- **GND** Screw terminal is the ground reference for the regulated and unregulated power terminals.
- **12/24** Screw terminal is commonly used to provide operating voltage to a external GPS, Dual Antenna Arbitrator or other below decks tone generators or switches. Voltage output is based on the T.M.S assemblies JP5 jumper settings.

3.3.6.4. TS5 NMEA A/B, GPS output.

- **RxA- and RxA+** screw terminals, which are defined as the NMEA A connection is used to connect to the ships Gyro Compass (Heading). The NMEA0183 compliant inputs are then connected via a 9 pin ribbon cable to the ACU's J2 NMEA communications port. A GPS (Latitude and Longitude) input may also be connected, but is not required because there is a GPS device already installed in your antenna.. **NOTE: If you connect a ships GPS to the terminal mounting strip, you *MUST* disconnect the GPS antenna on the antenna pedestal.**
- **RxB- and RxB+** screw terminals, which are defined as the NMEA B connection is used to connect to the ships Gyro Compass (Heading). The NMEA0183 compliant inputs are then connected via a 9 pin ribbon cable to the ACU's J2 NMEA communications port. A GPS (Latitude and Longitude) input may also be connected, but is not required because there is a GPS device already installed in your antenna.
- **TxA-** screw terminal is used to provide a Pseudo GPS (GGA and GLL formats) output to other system components such as a Satellite Modem.



3.4.Final Checks

3.4.1. Visual/Electrical inspection

Do a visual inspection of your work to assure that everything is connected properly and all cables/wires are secured.

3.4.2. Electrical - Double check wiring connections

Double check all your connections to assure that it is safe to energize the equipment.

3.5. Power-Up

Verify that all shipping straps and restrains have been removed prior to energizing the antenna.

When all equipment has been installed, turn ACU Power and Antenna power ON. The ACU will initially sequentially display:

“SEA TEL – MASTER and DAC-2202 VER 6.xx” followed by,

“SEA TEL – RCVR and SCPC VER 5.xx” followed by,

“SEA TEL – IO MOD and COMMIF VER 1.xx” followed by,

“SEA TEL – REMOTE and INITIALIZING”. After initialization, the bottom line of the remote display will display the antenna model number and the software version from the PCU.

Energize and check the other Below Decks Equipment to verify that all the equipment is operating. You will need to assure that the ACU is setup correctly and that the antenna acquires the correct satellite before you will be able to completely check all the below decks equipment for proper operation.

3.6. Antenna Maintenance

3.6.1. Balancing the Antenna

The antenna and equipment frame are balanced at the factory however, after disassembly for shipping or maintenance, balance adjustment may be necessary. The elevation and cross-level motors have a brake mechanism built into them, therefore, **power** must be ON to release the brakes and **DishScan® and antenna drive** must be OFF to balance the antenna. **Do NOT remove any of the drive belts.** Balancing is accomplished by adding or removing balance trim weights at strategic locations to keep the antenna from falling forward/backward or side to side. The antenna system is not pendulous so 'balanced' is defined as the antenna remaining at rest when left in any position.

The "REMOTE BALANCE" parameter (located at the end of the Remote Parameters after REMOTE TILT) of the ACU. When enabled, Remote Balance Mode temporarily turns DishScan, Azimuth, Elevation and Cross-Level drive OFF. This function is required when trying to balance antenna systems that have a built-in brakes on the elevation and cross-level motors.

Assure that Antenna power is ON and that the antenna has completed initialization.

At the ACU:


1. From the ACU - REMOTE BALANCE parameter: Enable balance mode (refer to your ACU manual). The screen should now display "REMOTE BALANCE ON".

At the Antenna:

2. At the Antenna: Balance the antenna with the elevation near horizon (referred to as front to back balance) **by adding, or subtracting, small counter-weights.**
3. Then balance Cross Level axis (referred to as left-right balance) **by moving existing counter-weights from the left to the right or from the right to the left.** Always move weight from one location on the equipment frame to the same location on the opposite side of the equipment frame (ie from the top left of the reflector mounting frame to the top right of the reflector mounting frame). Do NOT add counter-weight during this step.
4. Last, balance the antenna with the elevation pointed at, or near, zenith (referred to as top to bottom balance) **by moving existing counter-weights from the top to the bottom or from the bottom to the top.** Always move weight from one location on the equipment frame to the same location on the opposite side of the equipment frame (ie from the top left of the reflector mounting frame to the bottom left of the reflector mounting frame). Do NOT add counter-weight during this step.
5. When completed, the antenna will stay at any position it is pointed in for at least 5 minutes (with no ship motion).
6. **Do NOT cycle antenna power to re-Initialize the antenna.** Return to the ACU, which is still in REMOTE BALANCE mode, and press ENTER to exit Remote Balance Mode. When you exit Balance Mode the antenna will be re-initialized, which turns DishScan®, Azimuth, Elevation and Cross-Level drive ON.

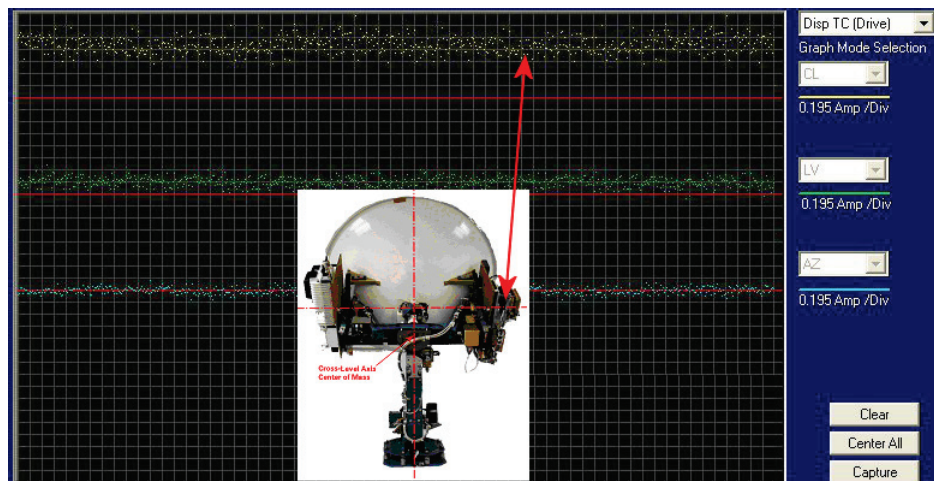
3.6.2. Fine Balance and Monitoring Motor Drive Torque

The DacRemP **DISPTC** graph chart provides a means for monitoring torque commands required for each motor for diagnostic purposes and verifying antenna balance. By observing each trace, the required drive of the antenna via the motor driver PCB may be established.

- To view the Torque Commands, select the  graph chart.
- This chart displays the Torque Command errors for each axis via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.195 amps/vertical division.
- A normal trace display will be ± 1 divisions from the red reference line while under calm sea conditions and with DishScan® Drive turned off. See example below
- In all axes, tracing centered on the reference line means that that axis is neutral. Tracing **above** the reference line means that that axis is driving CCW. Tracing **below** the reference line means that that axis is driving CW.

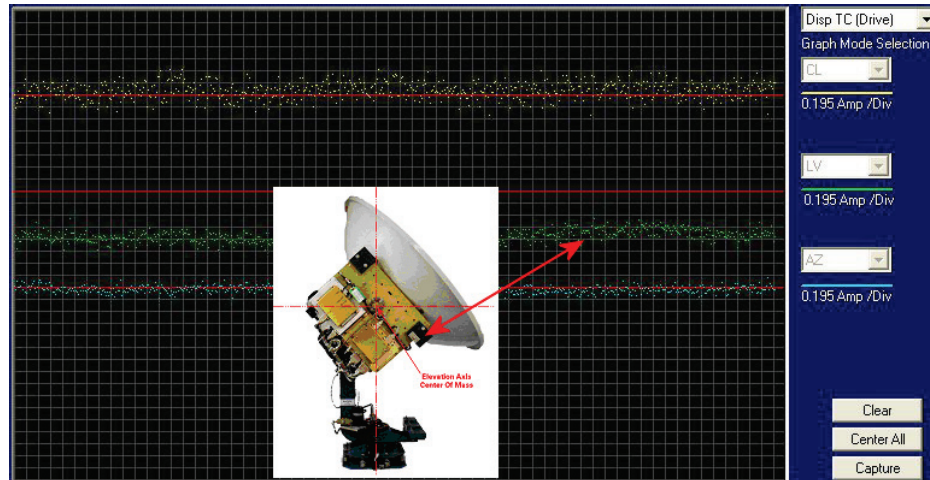


- The Cross Level displayed above the reference line indicates that CL is driving CCW (Left).
Example: The antenna pictured in the screen capture below is imbalanced so that it is “Right Heavy”. The CL trace is plotting above the red reference line (indicating that drive CCW is required to keep the Cross-Level beam level (to the horizon)).



- The Level display will plot below the reference line when the antenna requires CW drive (Up in elevation).

Example: The antenna pictured in the screen capture below is imbalanced so that it is “Front, or Bottom, Heavy”. The LV trace is plotting above the red line, indicating that CW drive is required to maintain the current elevation position.



- The Azimuth display plots below the red line when as the antenna is driven CW and plots above the red line as the antenna is driving CCW.

4. Basic Setup of the ACU

4.1. Operator Settings

Refer to the Operation chapter of this manual to set the Ship information. Latitude and Longitude should automatically update when the GPS engine mounted on the antenna pedestal triangulates an accurate location, but you may enter this information manually to begin. Except when integrating NMEA-0183 Gyro source, you will have to enter the initial Heading of the ship, subsequently the ACU will then increment/decrement as the Gyro Compass updates.

Next, set the Satellite information. Longitude of the desired satellite you wish to use and the receiver settings for it are especially important.

At this point you should be able to target the desired satellite. Continue with the setup steps below to optimize the parameters for your installation.

4.2. SETUP Parameter display and entry menus.



Press and hold BOTH the LEFT and the RIGHT arrow keys **for 6 seconds** to access to the system setup parameters (at the **EL TRIM** selection). **Press** BOTH the LEFT and the RIGHT arrow keys **momentarily** to access to the **SAVE NEW PARAMETERS** parameter.

Access is only required after installation or repairs of your antenna system. These parameters should only be changed by an authorized service technician.

CAUTION: Improper setting of these parameters will cause your system to not perform properly. Also refer to the SETUP section of your Antenna manual.

4.3. Default Setup Parameters for your Antenna

The following table shows the factory default parameters for the DAC-2202 Antenna Control Unit interfaced to an Antenna PCU. When you receive the system it will have factory default settings in the ACU. After installation of the system, some of the settings will remain at factory default and others should be optimized for specific applications.

PARAMETER	ST60-2 C-Band	Optimize using Lesson
AUTO TRIM		Setup – Targeting
EL TRIM	0	
AZ TRIM	0	
AUTO THRES	100	Leave at factory Defaults
EL STEP SIZE	0	
AZ STEP SIZE	0	
STEP INTEGRAL	0	
SEARCH INC	20	Setup - Searching
SEARCH LIMIT	200	
SEARCH DELAY	30	
SWEEP INC	47	
SYSTEM TYPE	69	Leave at factory Defaults
GYRO TYPE	2 (NMEA/SBS)	Setup – Ships Gyro Compass
POL TYPE	73	Setup – Polarity Selection AND Setup – Optimizing Polarization
POL OFFSET	30	
POL SCALE	90	

AZ LIMIT 1	0	Setup – Blockage & RF Radiation Hazard Zones
AZ LIMIT 2	0	
EL LIMIT 12	90	
AZ LIMIT 3	0	
AZ LIMIT 4	0	
EL LIMIT 34	90	
AZ LIMIT 5	0	
AZ LIMIT 6	0	
EL LIMIT 56	90	
5v OFFSET	0	Leave at factory Defaults
5V SCALE	0	Leave at factory Defaults
TX POLARITY	2	Leave at factory Defaults
TRACK DISP	0	Setup – Polarity Selection

REMOTE PARAMETER	ST60-2 C-Band	Optimize using Lesson
PCU Configuration Number N0xxx	003	Leave at factory Defaults
Home Flag Offset N6xxx	000	Setup – Home Flag Offset
DishScan Phase/Gain N7xxx	26	Leave at factory Defaults

4.4. SAVE NEW PARAMETERS

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access “SAVE NEW PARAMETERS” directly from any other menu display. Verify that the change(s) you have made is/are correct and then select “SAVE NEW PARAMETERS”. Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

5. Setup – Ships Gyro Compass

The Ships Gyro Compass connection provides true heading (heading of the ship relative to true North) input to the system. This allows the ACU to target the antenna to a “true” Azimuth position to acquire any desired satellite.

After targeting this input keeps the antenna stabilized in Azimuth (keeps it pointed at the targeted satellite Azimuth). In normal operation when viewing and ADMC recording in DacRemP, the “Relative Azimuth” trace should do exactly **equal & opposite** to whatever the Heading trace does and the “Azimuth” trace should stay flat.

In normal operation the heading display in the ACU should at all times be the same value as the reading on the Gyro Compass itself (this is also referred to as Gyro Following.).

If the ACU is not Following the Ships Gyro Compass correctly (un-erringly) refer to the Troubleshooting Gyro Compass Problems.

5.1. GYRO TYPE

The GYRO TYPE parameter selects the type of gyro compass interface signal, the appropriate hardware connections and the ratio of the expected input signal for ship turning compensation. Default GYRO TYPE parameter for all systems is 0002 so that the ACU will properly follow for Step-By-Step or NMEA gyro signals.

If the Ships Gyro Compass output is Synchro, or there is NO Gyro Compass, the GYRO TYPE parameter must be set correctly to properly read and follow the Ships Gyro Compass signal that is being provided. The acceptable settings are:

362	for 360:1 Synchro with S/D Converter
90	for 90:1 Synchro with S/D Converter
36	for 36:1 Synchro with S/D Converter
2	for Step-By-Step gyro or NMEA gyro
1	for 1:1 Synchro with S/D Converter
0	for No Gyro linear AZ Search Mode (No Heading input available)

5.2. Updating the GYRO TYPE parameter

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

When you are finished making parameter changes, go to the SAVE NEW PARAMETERS display to save the changes you have made.

5.3. If There is NO Ships Gyro Compass

Without heading input to the system the ACU will **NOT** be able to target, or stay stabilized **ON**, a “true” azimuth pointing angle. This will make satellite acquisition much more difficult and the true azimuth value that any given satellite should be at will not be displayed correctly.

This mode of operation is NOT recommended for ships. A better solution would be to provide a Satellite Compass (multiple GPS Antenna device) to provide true heading input to the ACU. These devices are readily available and are much less expensive than a Gyro Compass.

If there is NO Gyro Compass (ie on a large stationary rig which is anchored to the ocean floor) set the GYRO TYPE parameter to 0000, the SWEEP INC parameter to 0047 and SAT REF (Satellite Reference Mode) **MUST** be turned **ON**. This combination of settings will cause “No Gyro” Search pattern to be use to find the desired satellite (refer to the setup – Searching lesson).

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6. Setup – Tracking Receiver

6.1. Determining the IF Tracking Frequency (FREQ or MHz)

The IF Tracking parameter is a calculated value entered into the ACU's **MHz** Sub-Menu. The value itself is calculated by using the formula $RF - LO = IF$.

When you take the Satellite Transponder Downlink RF value and subtract the LNB's Local Oscillator (LO) Value, the resultant value will equal the Intermediate Frequency (IF). It is this IF value that will be entered into the ACU for tracking purposes.

Example assuming an LNB LO value of 11.25GHz: $12268 - 11250 = 1018$ MHz IF

Provider Name	Character Name	System	Encryption	RF Freq.	SID-VPOD	Path-TID	Beam	Status
dish	DISH Network	DVB	No encryption	12268 MHz	11250-11250	Spur 1	Beam 1	OK

Identifying the Downlink RF using Capture from Lyngsat.com

6.2. KHz

The KHz rate entered into the ACU is an absolute value which also may have been provided by your air-time provider, or have been calculated, and is entered directly in this sub-menu window.

In the example above, 1018.0 MHz was calculated (1018 MHz 000 KHz) therefore, the KHz entry would be 000. If the provided/calculated value had been 1018.250, 1018 would have been entered in the MHz window and 250 would be entered in the KHz window.

6.3. FEC

6.3.1. L-Band SCPC Receiver

The Forward Error Correction rate entered into the ACU should always be set to **SCPC** with an L-Band SCPC receiver card installed in the ACU.

6.4. Tone

6.4.1. TVRO Applications

The Tone state entered into the ACU will be toggled either on or off. Although there are many possibilities of uses of a 22 KHz tone, in a Sea Tel TVRO antenna system it is primarily used for below decks band selection (Tone On = Ku Hi-Band and Tone Off = Ku Lo-Band) and is based on the Downlink RF value from the satellite. An RF Downlink value is less than 11699 is considered to be Ku-Lo band and tone must be turned "Off" for proper port selection of the Multiswitch. An RF Downlink value greater than 11700 is Ku-Band Hi-band and tone must be turned "On" for proper port selection of the Multiswitch. When using a Public Satellite Reference Site such as Lyngsat.com, refer to the Frequency value to determine whether tone is required, or not, for tracking purposes. Refer to the IF Tracking Frequency graphics above to identify a satellite transponders Downlink RF value.

6.5. Volt

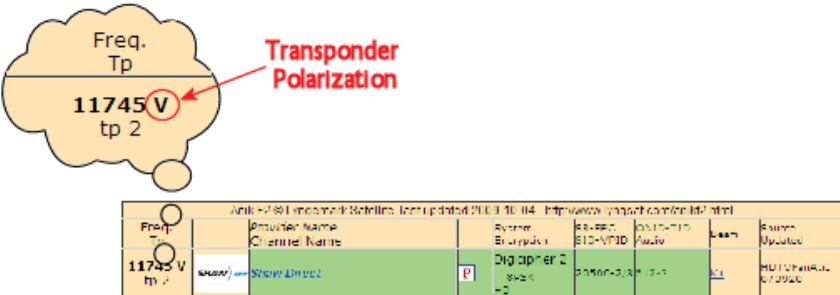
6.5.1. TVRO Application

The Voltage setting in the ACU is a selection of one of four receiver options and is based on the Downlink RF Polarization from the satellite. In a TVRO application, receiver voltage is used for proper port (receive polarization) selection. The polarization type should be provided to the operator/technician by the NOC prior

ST60-2 C-Band TVRO

to, or during the commissioning process. When using a Public Satellite Reference Site such as Lyngsat.com, Polarization is abbreviated “Pol.”

Receiver Voltage Selection	Receiver Voltage output	Reference Website Abbreviation
RHCP (Right Hand Circular Polarization)	13VDC	R
LHCP (Left Hand Circular Polarization)	18VDC	L
VERT (Vertical Linear Polarization)	13VDC	V
HORZ (Horizontal Linear Polarization)	18VDC	H



6.6. SKEW

SKEW will only be used to optimize the polarization of *linear* feeds to match the *linear* signal from the satellite. The C-Band *Circular* feed does *not* require polarization adjustment, therefore, the Skew setting will be 0000 when using C-Band circular satellite signals. To optimize the polarization of the Ku-Band *linear* feed, refer to “Optimizing Ku-Band Linear Polarization:” in chapter 15.

6.7. NID

Set NID to 0000

7. Setup - Polarity Select

You may wish to optimized the feed assembly for the services that you will be using:

- LHCP for AFRTS/DTS Services
- RHCP for MTN services

7.1. Fixed Frequency Low Noise Block Converter Operation/Selection:

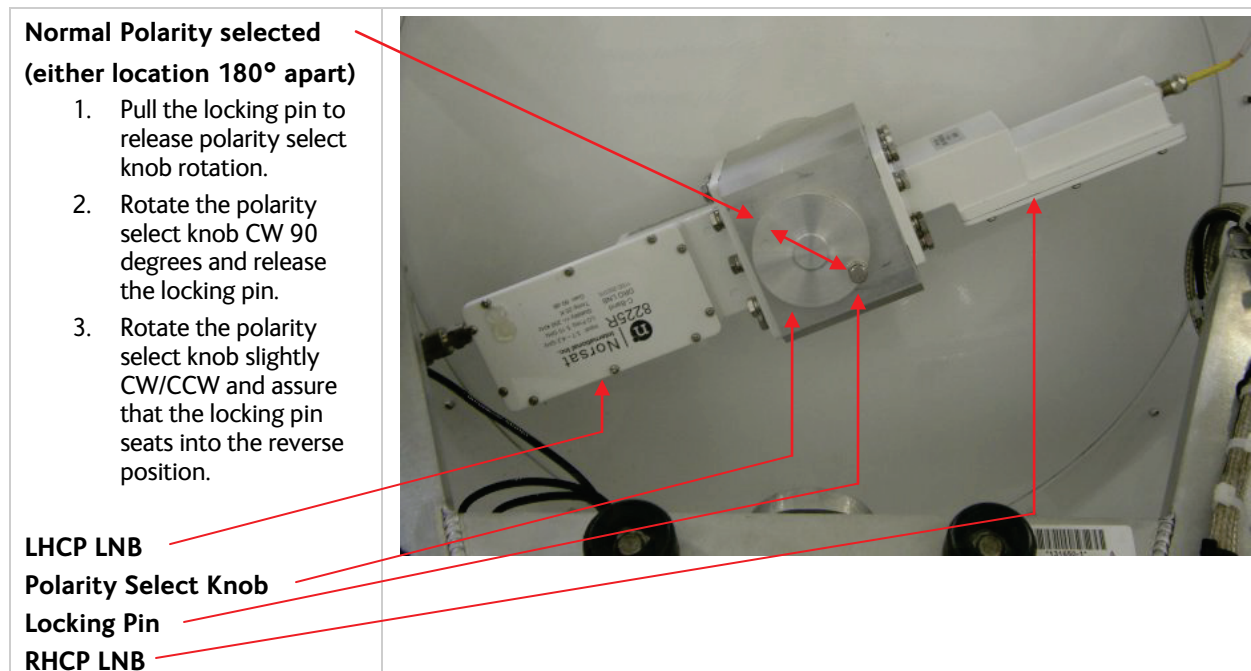
When you have your C-Band, and/or Ku-Band fixed frequency LNBs, you must set the “TrackDisp” parameter to 0000. Band selection controls the **local** logic output state of SW1 output terminal on the Terminal Mounting Strip PCB **AND remote** 22KHz tone, 13/18 VDC LNB power and relays or switches on the antenna pedestal.

When you are operating at C-Band, select C, when using Ku band with a fixed frequency LNB installed on the feed select KuLo for low band operation or KuHi for high band operation.

Setting	Displayed band selection	ADE Band Select Parameters (Tone, Voltage & Aux Status)	TMS SW1 Status
0000	C	Tone OFF, Volt 13, Aux 0	Open
	X	Tone OFF, Volt 18, Aux 0	Short
	KuLo	Tone OFF, Volt 13, Aux 1	Open
	KuHi	Tone OFF, Volt 18, Aux 1	Short

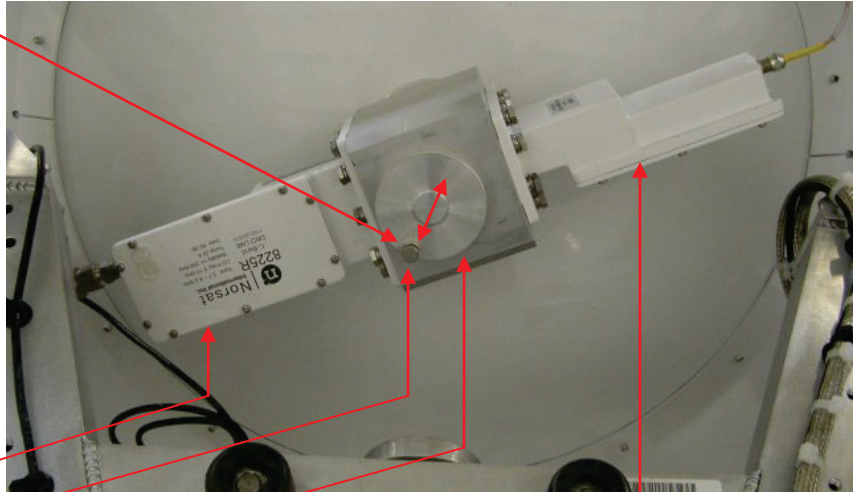
7.2. C-Band Feed Assembly Polarity Selection:

The Dual-Polarity C-Band TVRO Feed Assembly has two C-Band LNBs installed on it. One LNB will be LHCP and the other will be RHCP. The polarity if these two can be reversed if desired (the LHCP LNB will become RHCP and the RHCP will become LHCP when the polarity select knob is rotated 90 degrees from the “Normal” polarity position to the “Reverse” polarity position.



**Reverse Polarity selected
(either location 180° apart)**

1. Pull the locking pin to release polarity select knob rotation.
2. Rotate the polarity select knob 90 degrees and release the locking pin.
3. Rotate the polarity select knob slightly CW/CCW and assure that the locking pin seats into the reverse position

**RHCP LNB****Locking Pin****Polarity Select Knob****LHCP LNB**

8. Setup – Targeting

In this lesson you will learn how to optimize the targeting of the antenna to land on or near a desired satellite (within +/- 1 degree).

8.1. AUTO TRIM

The Auto Trim function will automatically calculate and set the required Azimuth and Elevation trim offset parameters required to properly calibrate the antennas display to the mechanical angle of the antenna itself, while peaked ON satellite.

Refer to “Optimizing Targeting” in the Setup section of this manual for further details on the parameters settings.

To enable this function, the Antenna **MUST** be actively tracking the satellite with positive SAT ID and elevation of the antenna must be less than 83 degrees and the ACU must **NOT** be set for Inclined Orbit Search. After locating the satellite, with Tracking ON, wait at least 30 seconds before performing the AUTO TRIM feature, this will allow sufficient time for the antenna to peak up on signal. It is equally important that you verify that the system is tracking the **CORRECT** satellite (verify video is produced on the Televisions in a TVRO system or verify a RX lock indication on the satellite modem in a VSAT system).

While in the AUTO TRIM sub-menu, press the **LEFT** arrow key to bring start the calibration procedure, the display should read AUTO TRIM SETUP, press the **ENTER** key to submit. AUTO TRIM SAVED will be displayed, indicating the proper AZ and EL trims were submitted to RAM. This does not save these parameters to NVRAM, in order to save to memory, continue down through the setup mode parameters until the **SETUP SAVE NEW PARAMETERS** sub menu is displayed. Press the **RIGHT** arrow and then press the **ENTER** key. The display should now report that the parameters were saved. From the AUTO TRIM SETUP screen, press the **NEXT** key (DAC2202) without hitting **ENTER** to escape this screen without submitting the new AZ and EL Trim values.

NOTE: AUTO TRIM LOCKED will be displayed on the front panel, indicating that the AUTO TRIM Feature is **NOT** allowed if all of these conditions are not met:

The ACU **must** be actively tracking a satellite (AGC above threshold) **and**

The ACU **must** have positive SAT ID (internal NID match or external RX lock received from the Satellite Modem) **and**

The elevation angle of the antenna **must** be LESS than 75 degrees **and**

The ACU **must** NOT be set for Inclined Orbit Search.

8.2. Manually Optimizing Targeting

First, assure that all of your Ship & Satellite settings in the ACU are correct.

1. Target the desired satellite, immediately turn Tracking OFF, and record the Azimuth and Elevation positions in the “**ANTENNA**” display of the ACU (these are the **Calculated** positions).
2. Turn Tracking ON, allow the antenna to “Search” for the targeted satellite and assure that it has acquired (and peaks up on) the satellite that you targeted.
3. Allow several minutes for the antenna to “peak” on the signal, and then record the Azimuth and Elevation positions while peaked on satellite (these are the Peak positions). Again, assure that it has acquired the satellite that you targeted!
4. Subtract the Peak Positions from the Calculated Positions to determine the amount of Trim which is required. Refer to the ACU Setup information to key in the required value of Elevation Trim.
5. Continue with Azimuth trim, then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

EXAMPLE: The ACU targets to an Elevation position of 30.0 degrees and an Azimuth position of 180.2 (Calculated), you find that Peak Elevation while ON your desired satellite is 31.5 degrees and Peak Azimuth is 178.0. You would enter an EL TRIM value of -1.5 degrees (displayed as -0015) and an AZ TRIM of +2.2 degrees (displayed as 0022). After these trims values had been set, your peak **on satellite** Azimuth and Elevation displays would be very near 180.2 and 30.0 respectively.

8.3. **EL TRIM**

Elevation trim offset parameter is entered in tenths of degrees. Adjusts display to correct for antenna alignment errors or imbalances in the antenna system. Increase number to increase display. Refer to “Optimizing Targeting” in the Setup section of your antenna manual.

To update: While in the EL TRIM sub-menu, press the LEFT arrow key to bring the cursor under the ones digit. Press the UP or DOWN arrow key to increment or decrement the selected digit. Minus values are entered by decrementing below zero. Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

Continue with Azimuth trim, then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

8.4. **AZ TRIM**

Azimuth trim offset parameter is entered in tenths of degrees. Offsets true azimuth angle display to compensate for installation alignment errors when used with Ships Gyro Compass input reference. **Azimuth Trim does not affect REL azimuth reading.** Increase number to increase displayed value. Refer to “Optimizing Targeting” in the Setup section of your antenna manual.

To update: While in the AZ TRIM sub-menu, press the LEFT arrow key to bring the cursor under the ones digit. Press the UP or DOWN arrow key to increment or decrement the selected digit. Minus values are entered by decrementing below zero. Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

Then re-target the satellite several times to verify that targeting is now driving the antenna to a position that is within +/- 1.0 degrees of where the satellite signal is located.

9. Setup – Home Flag Offset

Home Flag Offset is used to calibrate the relative azimuth value of the antenna to the bow line of the ship. This assures that the encoder input increments/decrements from this initialization value so that the encoder does not have to be precision aligned. When the antenna is pointed in-line with the bow (parallel to the bow) the “Relative” display value should be 000.0 **Relative** (360.0 = 000.0). Good calibration is especially important if blockage mapping is used, because the values entered into the AZ LIMIT parameters are entered in **Relative** Azimuth. The default Home Flag Offset value saved in the PCU is 000.

The Home Flag Sensor mounted on the pedestal is actuated by a metal tab mounted on the azimuth spindle which causes it to produce the “Home Flag” signal.

The default mounting of the radome is with its bow reference in-line with the bow and the base hatch in-line with the stern (aft reference of the radome). There are valid reasons for mounting the ADE in a different orientation than the default. One of these would be that the hatch of radome needs to be oriented inboard of the ship for safe entry into the dome (ie ADE is mounted on the Port, or Starboard, edge of the ship and safe entry is only available from inboard deck or inboard mast rungs).

Observe initialization of the antenna. When Azimuth drives CW and then stops at “Home” position, VISUALLY compare the antennas pointing, while at Home position, to the bow-line of the ship (parallel to the Bow).

If it appears to be very close to being parallel to the bow, you will not need to change the HFO and should proceed with Optimizing Targeting. When “Optimizing Targeting” small variations (up to +/- 5.0 degrees) in Azimuth can be easily corrected using the AZ TRIM parameter.

If it is NOT close (stops before the bow or continues to drive past the bow) HFO needs to be adjusted.

If the antenna is pointing to the LEFT of the bow line: If the antenna stops driving before the bow line, when targeting a satellite it will fall short of the desired satellite by exactly the same number of degrees that it fell short of the bow line. You must calibrate HFO using either of the methods below.

If the antenna is pointing to the RIGHT of the bow line: If the antenna continues to drive past the bow line, when targeting a satellite it will overshoot the desired satellite by exactly the same number of degrees that it went past the bow line. You must calibrate HFO using either of the methods below.

If you find that a large value of AZ TRIM parameter has been used to calibrate the antenna, This indicates that the Relative position is incorrect and should be “calibrated” using the correct HFO value **instead** of an Azimuth Trim offset.

If the radome was purposely rotated, has a large value of AZ TRIM or was inaccurately installed (greater than +/- 5 degrees), there are two ways of setting Home Flag to compensate for the mounting error. They are:

9.1. Electronic Calibration of Relative Antenna Position (Home Flag Offset)

Above, you VISUALLY compared the antenna pointing, while at “Home” position, to the bow-line of the ship and found that the antenna pointing was **NOT close** to being parallel to the bow-line. It stopped before the bow or went past the bow **OR** you found **AZ TRIM** has been set to a large value, therefore, **HFO needs to be adjusted**.

Ascertain the exact amount of error using the appropriate procedure below, enter the HFO to calibrate the antenna to the ship, save the value and re-initialize the antenna to begin using the new value.

9.1.1. You Found a Large AZ TRIM value:

If Targeting has been optimized by entering a large value of AZ TRIM; First, verify that you are able to repeatedly accurately target a desired satellite (within +/- 1.0 degrees). Then you can use the AZ TRIM value to calculate the value of HFO you should use (so you can set AZ TRIM to zero). AZ Trim is entered as the number of **tenths** of degrees. You will have to convert the AZ TRIM value to the nearest **whole** degree (round up or down as needed). Calculated HFO value is also rounded to the nearest whole number.

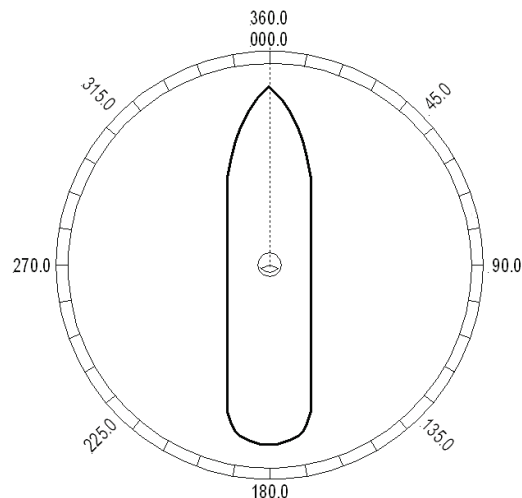


Figure 9-1 Antenna stops In-line with Bow

If AZ TRIM was a **plus** value: $HFO = (TRIM / 360) \times 255$ Example: AZ TRIM was 0200 (plus 20 degrees). $HFO = (20/360) \times 255 = (0.0556) \times 255 = 14.16$ round off to 14. Set, and Save, HFO to 014 using the “To Enter the HFO value” procedure below.

If AZ TRIM was a **negative** value: $HFO = ((360-TRIM) / 360) \times 255$ Example: AZ TRIM = -0450 (minus 45 degrees). $HFO = ((360 - 45) / 360) \times 255 = (315 / 360) \times 255 = 0.875 \times 255 = 223.125$ round off to 223. Set, and Save, HFO to 223 using the “To Enter the HFO value” procedure below.

9.1.2. You Observe “Home” Pointing is LEFT of the Bow-line:

1. In this example, I observe that the Home position is short of the bow line.
2. I estimate that it is about 45 degrees.
3. I target my desired satellite and record the Calculated Azimuth to be 180.5.
4. I drive UP (I estimated that I will need to go UP about 45 degrees) and finally find my desired satellite.
5. Turn tracking ON to let the ACU peak the signal up. When peaked, the Azimuth is 227.0 degrees.
6. I subtract Calculated from Peak ($227 - 0180.5 = 46.5$) and difference is 46.5 degrees.
7. I can calculate what the correct value for the Home position of the antenna by subtracting (because “home” was to the left of bow) this difference of 46.5 from the bow line position 360.0. Therefore “home” should be 313.5 Relative.
8. I now calculate the HFO = $(313.5 / 360) \times 255 = 0.87 \times 255 = 222.06$ which I round off to 222.
9. I set, and Save, HFO to 222 using the “To Enter the HFO value” procedure below. After I re-initialize the relative position of the antenna is now calibrated.
10. If there is a small amount of error remaining, use AZ TRIM in the Optimizing Targeting procedure to correct it.

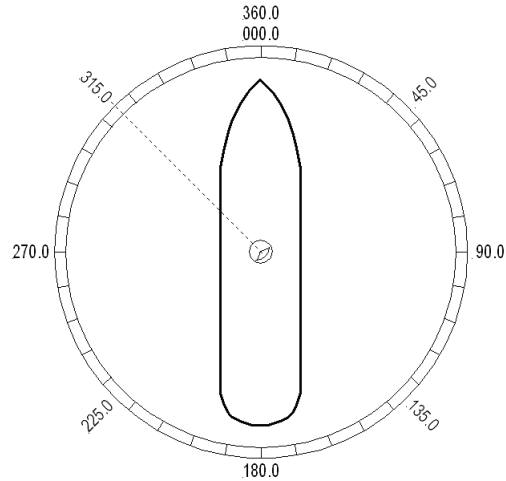


Figure 9-2 Antenna stopped before the Bow

9.1.3. You Observe “Home” Pointing is RIGHT of the Bow-line:

1. In this example, I observe that the Home position is past the bow line.
2. I estimate that it is about 90 degrees.
3. I target my desired satellite and record the Calculated Azimuth to be 180.0.
4. I drive DOWN (I estimated that I will need to go **DOWN** about 89 degrees) and finally find my desired satellite.
5. Turn tracking ON to let the ACU peak the signal up. When peaked, the Azimuth is 90.0 degrees.
6. I subtract Calculated from Peak ($180.0 - 90.0 = 90.0$) and difference is 90.0 degrees.
7. I can calculate what the correct value for the Home position of the antenna by **adding** (because

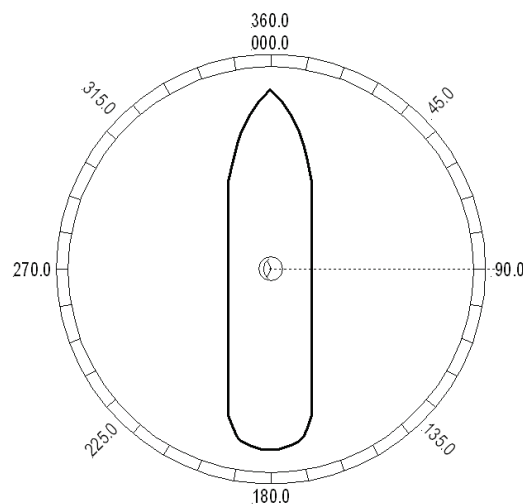


Figure 9-3 Antenna stops past the Bow

“home” was to the right of bow) this difference of 09.0 to the bow line position 000.0. Therefore “home” should be 90.0 Relative.

8. I now calculate the HFO = $((90.0) / 360) \times 255 = 0.25 \times 255 = 63.75$ which I round off to 64.
9. I set, and Save, HFO to 222 using the “To Enter the HFO value” procedure below. After I re-initialize the relative position of the antenna is now calibrated.
10. If there is a small amount of error remaining, I will use AZ TRIM in the Optimizing Targeting procedure to correct it.

9.1.4. To Enter the HFO value in the DAC 2202:

To enter the calculated HFO value, press & hold both LEFT and RIGHT arrows for six seconds to enter the parameter menu at the EL TRIM parameter window. Press DOWN arrow key numerous times (about 21) until you have selected the REMOTE COMMAND window.

In the REMOTE COMMAND window, press the LEFT arrow key until you have underscored the left most character in the displayed value (ie the A in “A0000”). Use the UP/DOWN arrow keys to increment/decrement the underscored character until it is upper case **N** (“N0000” should appear in the command window). Press the RIGHT arrow key to move the cursor under the most significant digit, then use the UP arrow key to increment it to a value of 6 (the display is now “N6000”). Set the three digits to the right of the 6 to the three digit HFO value from 000 to 255 (corresponding to 0 to 360 degrees) that you calculated above. Use the LEFT/RIGHT keys to underscore the desired digit(s) then use the UP/DOWN arrow keys to increment/decrement the underscored value. When you have finished editing the display value, press ENTER to send the HFO value command to the PCU (but it is not save yet).

If you want to find out what the **current** HFO value is key in N6999 and hit **ENTER**.

When completed, you must save the desired HFO value. Press ENTER several times to select the REMOTE PARAMETERS display. Press the LEFT or RIGHT arrow key to enter writing mode and then press the ENTER to save the HFO value in the PCUs NVRAM.

EXAMPLE: In the “You Observe “Home” Pointing is LEFT of the Bow-line” example above, the HFO calculated was 222. To enter this value:

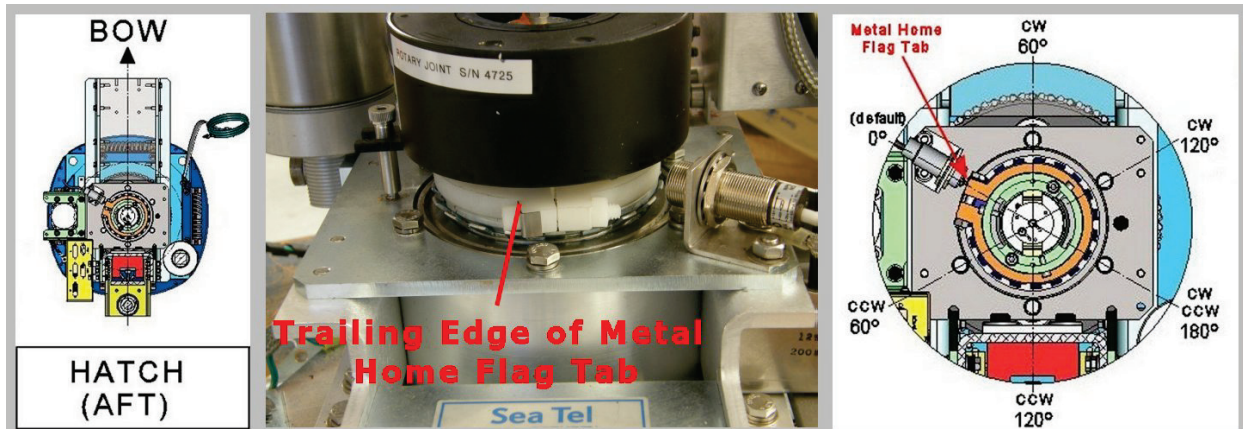
1. Set the Remote Command value to “**N6222**”.
2. Press **ENTER** to send this HFO to the PCU. The display should now show “N0222”.
3. When completed, you must save the desired HFO value. Press **ENTER** several times to select the **REMOTE PARAMETERS** display. Press the **LEFT** or **RIGHT** arrow key to enter writing mode and then press the **ENTER** to save the HFO value in the PCUs NVRAM.

You must drive the antenna CW in azimuth until the home switch is actuated, or re-initialize the antenna **to begin using the new HFO value** you have entered and saved. To re-initialize the antenna from the REMOTE COMMAND window of the ACU;

4. Press **UP** arrow key several times to return to the **REMOTE COMMAND** display.
5. Press the **LEFT** or **RIGHT** arrow key to enter edit mode. Use the **LEFT/RIGHT** and **UP/DOWN** arrow keys to set the character and digits to “**~0090**” and then press the **ENTER** key.

This resets the PCU on the antenna. The antenna will reinitialize with this command (Performs a similar function as a power reset of the antenna) and the new home flag offset value will be used to calibrate the Relative position of the antenna.

9.2. Mechanical Calibration of Relative Antenna Position (Home Flag Offset)



During initialization, azimuth drives the antenna CW until the Home Flag Switch senses the trailing edge of the metal tab (**as shown in the left picture above**). The sensor will appear to go past the metal tab, then come back to the trailing edge of the metal tab and stay there. This “home” position orients the pedestal to the “BOW” reference in the radome which is directly forward of the entry hatch in the radome base. The Home Flag signal into the PCU “presets” the relative position counter to the value stored in the Home Flag Offset (**default value saved in the PCUs is 000**). This assures that the encoder input increments and decrements from this initialization value, therefore, does not have to be precision aligned.

The metal Home Flag tab is mounted in a nylon clamp assembly. The nylon bolt/nut can be loosened to rotate the clamp around underneath the power ring. (**as shown in the center picture above**).

In the simplest scenario, if you could rotate the antenna pedestal to be in-line with the bow and then rotate the home flag clamp assembly around until the trailing edge is centered on the body of the home flag sensor, and tighten the clamp HFO would be set close enough for “Optimizing Targeting” procedure to be effective. Unfortunately, rarely is the equipment going to align where the clamp and sensor will be easy to access, reach and see, to align it this way.

The hex bolt heads in the plate below the Home Flag Clamp assembly are 60 degrees apart (**as shown in the picture on the right above**) and allow multiple points of view to calibrate rotation of the clamp to.

If you installed the ADE with the “Bow” reference of the radome oriented in-line with the bow, the antenna pedestal will be pointed in-line with the ships bow when stopped at the Home Flag position on completion of initialization (before it targets a satellite) as shown in Figure 1 in the Electrical Calibration Procedure above. In this case, when the antenna stops at the home flag and is pointed in-line with the Bow, Home Flag Offset (HFO) should be set to zero and mechanical position of the metal Home Flag tab should be left at the 0° (default) position. Any small mechanical mount error will be compensated when “Optimizing Targeting” is accomplished to correct for small variations of up to +/- 5.0 degrees.

If the ADE is installed with the “Bow” reference of the radome oriented 45° to starboard the pedestal, when at home flag position, will be pointed 45° CCW of the bow (at relative 315° as shown in Figure 2 in the Electrical Calibration Procedure above). To compensate for this, loosen the home flag clamp, rotate the trailing edge of the metal home flag tab **CW 45°** and tighten the clamp bolt (**use caution not to tighten too much and strip the nylon hardware**).. You will have to estimate this 45° rotation based on the 60° spacing of the hex bolt centers. Re-initialize the antenna and verify that when at home flag position it is pointed in-line with the ships bow. **Do NOT change the Home Flag Offset value saved in the PCU**, small variations will be compensated for when “Optimizing Targeting” is accomplished.

If the ADE is installed with the “Bow” reference of the radome oriented 90° to port, the pedestal when at home flag position, will be pointed 90° CW of the bow (at relative 090° as shown in Figure 3 in the Electrical Calibration Procedure above). To compensate for this, loosen the home flag clamp, rotate the trailing edge of the metal home flag tab **CCW 90°** and tighten the clamp bolt (**use caution not to tighten too much and strip the nylon hardware**).. You will have to estimate this 90° rotation based on the 60° spacing of the hex bolt centers. Re-initialize the antenna and verify that when at home flag position it is pointed in-line with the ships bow. **Do NOT change the Home Flag Offset value saved in the PCU**, small variations will be compensated for when “Optimizing Targeting” is accomplished.

10. Setup – Searching

10.1. Searching Operation

The ACU will initiate an automated search pattern after AGC falls below the current Threshold setting (indicates that satellite signal has been lost). The SEARCH DELAY parameter sets the amount of delay, in seconds, that the ACU will wait after AGC has fallen below the threshold value before it starts a search.

Search can be initiated manually by pressing the **NEXT** key as many times as required to access the SETUP menu, then press the **ENTER** Key to access the SEARCH sub-menu and then press the **UP** arrow key (starts a search from the current antenna position). While in the SEARCH sub-menu, pressing the **DOWN** arrow key will stop the current search.

Search is terminated automatically when the AGC level exceeds the threshold value and Tracking begins.

The ACU can be configured to use one of three search patterns. Each of the search patterns are described below. Each description includes information about the settings involved in configuring the ACU to select that particular pattern and the values that those settings would be set to, to optimize the pattern for your antenna model and the frequency band being used.

The dimensions and timing of the search pattern are determined by the SETUP parameters **SEARCH INC**, **SEARCH LIMIT**, **SEARCH DELAY** and **SWEEP INC**. Search is also affected by the *Threshold* and the *internal receiver* settings under the Satellite menu. To change any one of these parameters, refer to “Changing the Search Parameters” procedures below.

All three search patterns are conducted in a two-axis pattern consisting of alternate movements in azimuth and elevation or along the polarization angle. The size and direction of the movements are increased and reversed every other time resulting in an increasing spiral pattern as shown.

10.1.1. Default Standard (Box) Search Pattern

The factory default search pattern in the ACU is a standard “box” pattern. You configure the ACU to use this pattern by using the following settings:

SEARCH INC - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

SEARCH LIMIT – initially set to the default value. After targeting has been optimized, the search limit can be adjusted if desired.

SEARCH DELAY – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

SWEEP INC – default value (this parameter is not used in this search pattern).

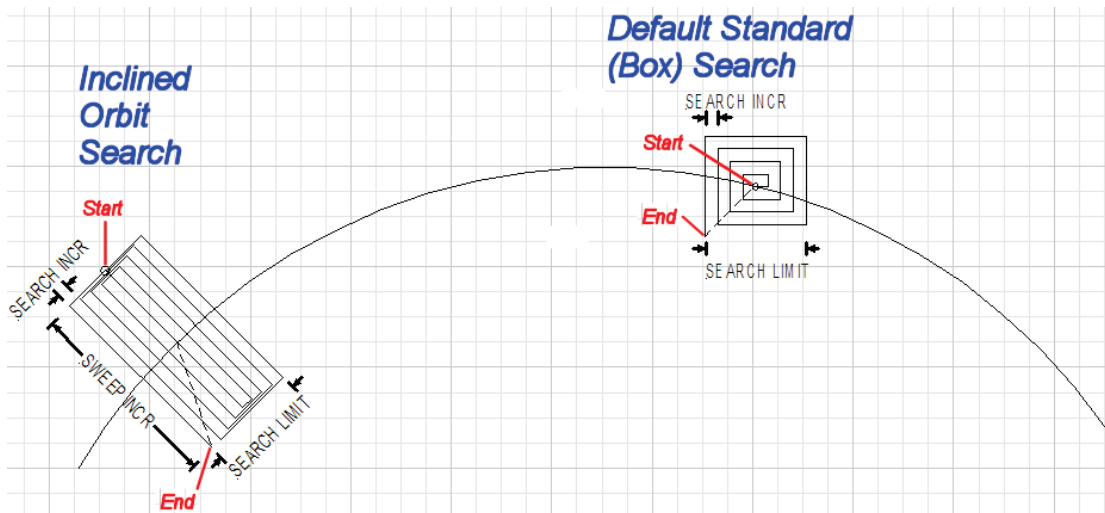
GYRO TYPE – must NOT be set to zero.

SAT REF mode – It is normally **OFF** as long as you have good gyro compass input. It **MUST** be **OFF** when the elevation angle is greater than 75 degrees. It **Must** be **ON** if you are experiencing frequent, or constant, gyro read errors (error code 0001).

Target any satellite longitude value which includes even tenths digit values (ie SAT 101.0 W or SAT 101.2 W). If the desired satellite longitude includes an odd tenths digit, you must round it up, or down, one tenth to make the tenths digit EVEN. The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will target the antenna. Initially the antenna will go to a position that is 8 degrees above the calculated elevation, until Azimuth and Polarization have had time to complete adjustment. Then the antenna will drive down to the calculated elevation, which is the “Start” of the search pattern in the graphic below.

The antenna will then search up in azimuth one Search Increment, search up one Search Increment in elevation, search down two Search Increments in azimuth, search down two Search Increments in elevation, etc until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna to the start point shown in the graphic below.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY seconds and then begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.



10.1.2. Inclined Orbit Search Pattern

Some older satellites, in order to save fuel to keep them exactly positioned over the Equator, are in an inclined geosynchronous orbit. The satellite remains geosynchronous but is no longer geostationary. From a fixed observation point on Earth, it would appear to trace out a figure-eight with lobes oriented north-southward once every twenty-four hours. The north-south excursions of the satellite may be too far off the center point for a default box search pattern to find that satellite at all times during the 24 hour period.

You can configure the ACU to do a special search pattern for a satellite that is in an inclined orbit by using the following settings:

SEARCH INC - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

SEARCH LIMIT – leave this set to the default value for your antenna model.

SEARCH DELAY – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

SWEEP INC – set to **192** if your antenna is a Series 04 or Series 06 or Series 09. Set to **193** if your antenna is a Series 97, Series 00 or Series 07. This parameter sets the sweep increment (shown in the graphic above) to be +/- 8.0 degrees above/below the satellite arc.

GYRO TYPE – must NOT be set to zero.

SAT REF mode – It is normally **OFF** as long as you have good gyro compass input. It **MUST** be **OFF** when the elevation angle is greater than 75 degrees. It **Must** be **ON** if you are experiencing frequent, or constant, gyro read errors (error code 0001).

Target the desired satellite longitude value but include an odd tenths digit (ie if you desire to target inclined satellite 186.0 W you would key in SAT 186.1 W for the ACU to do an inclined search). The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will target the antenna to.

Initially the antenna will go to a calculated position that is half of SWEEP INCR degrees above, and perpendicular to, the satellite arc (along the same angle as polarization for the desired satellite). This position is the "Start" of the search pattern in the graphic above. Then the antenna will drive down along the polarization angle SWEEP INCR degrees, step one Search Increment to the right (parallel to the satellite arc), search up along the polarization angle SWEEP INCR degrees, step two Search Increments to the left, search down, etc expanding out in the search pattern until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna to the calculated Azimuth and Elevation point.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY, then target the antenna to start point shown in the graphic above and begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.

10.1.3. No Gyro Search Pattern

If the ship does not have a gyro compass to use as a heading input to the Antenna Control Unit, you may manually key in the actual heading of the vessel and then re-target the desired satellite, every time you need to re-target a satellite, or configure the ACU to do a “No Gyro Search Pattern”.

You configure the ACU to use this pattern by using the following settings:

SEARCH INC - set to the default value for the frequency band that your antenna model is currently being used for (typically 15 counts).

SEARCH LIMIT – leave this set to the default value.

SEARCH DELAY – default, or any number of seconds from 1-255 that you would prefer that the ACU wait before starting an automatic search.

SWEEP INC – Larger antennas should have slower speeds and smaller antennas should have faster speeds:

Larger antennas should have slower speeds set to **0047** (= 5 degrees/second) for **2.4M to 3.6M antenna systems**).

Mid size antennas can be driven a little faster, set to **0063** (= 8 degrees/second) for **2M antenna models**).

Smaller antennas should have faster speeds, set to **0079** (= 18 degrees/second) for **all 0.8M to 1.5M antenna models**).

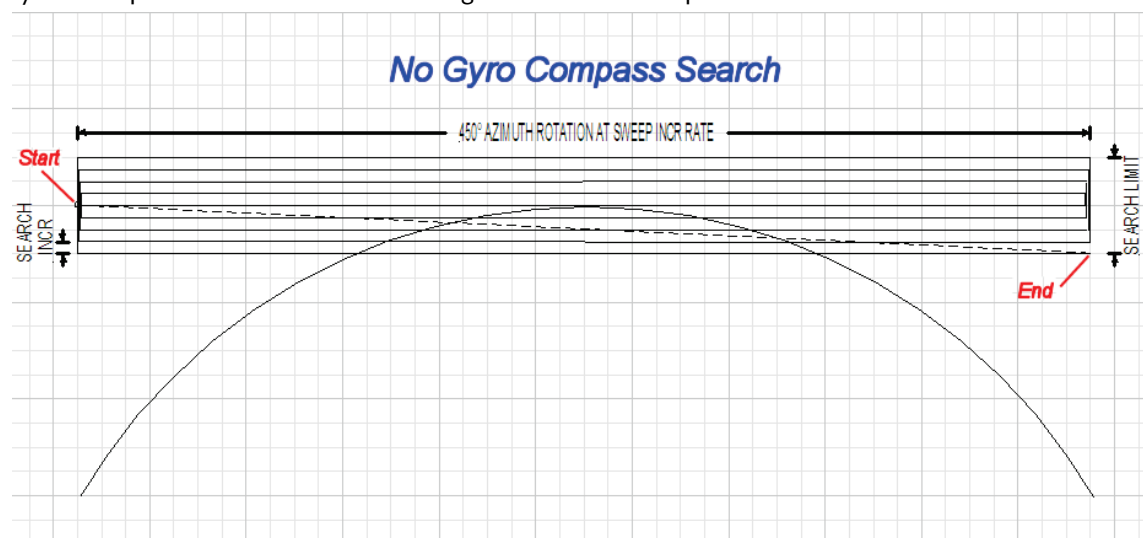
GYRO TYPE – **MUST** be set to **zero** for this search pattern.

SAT REF mode – **MUST** be **ON** for this search pattern.

Target any satellite longitude value which includes even tenths digit values (ie SAT 101.0 W or SAT 101.2 W). If the desired satellite longitude includes an odd tenths digit, you must round it up, or down, one tenth to make the tenths digit EVEN. The Antenna Control Unit calculates the Azimuth, Elevation and Polarization values it will use to target the antenna. However, without heading input, the ACU cannot target a “true azimuth” position (relative to true North). It will target the antenna to the calculated elevation and a repeatable “Start” relative azimuth position. In Series 04 antennas this relative position will be 90 degrees away from the nearest mechanical stop. In all other antennas it will be 000 degrees relative.

Initially the antenna will go to the “Start” relative azimuth position at the calculated elevation. Then the antenna will search up 450 degrees in azimuth, search up one Search Increment in elevation, search down 450 degrees in azimuth, search down two Search Increments in elevation, etc until Search Limit is reached. When the end of the search pattern is reached, the ACU will retarget the antenna back to the start point shown in the graphic below.

If the desired signal is found (AND network lock is achieved in the satellite modem) at this position, or anywhere within the search pattern, the ACU will terminate search and go into Tracking mode. If the desired signal is not found the ACU will wait SEARCH DELAY seconds and then begin the search pattern again. This cycle will repeat until the desired satellite signal is found or the operator intervenes.



10.2. *Changing the Search Parameters*

The information above described what some of these parameters need to be set to for a specific search pattern. Below are some additional pieces of information on the other parameters and the steps to change any one of these parameters.

10.2.1. AUTO THRES

Sets offset of AGC tracking threshold above the average noise floor. Units are in A/D counts, approximately 20 counts/dB. A setting of 0 disables auto threshold, therefore, the operator would have to manually enter a threshold value.

When AUTO THRESHOLD is enabled (any value between 1-255), the ACU automatically re-sets the AGC tracking threshold whenever the antenna Targets (AZ, EL or SAT) or Searches. The new AGC threshold is set to the average signal level input (approximate background noise level) plus the AUTO THRES offset value. EXAMPLE: If the Noise Floor off satellite is 1000 counts of AGC and Auto Threshold is set to 100, Threshold will be set to approximately 1100 after the antenna has finished targeting or Searching.

To change the Automatic Threshold value OR manually set threshold; Note the Peak “on satellite” AGC value, move EL and note the “off satellite” (Noise Floor) AGC value. Calculate the Difference between Peak AGC and Noise Floor AGC. AUTO THRES should be set to 1/3 (to 1/2) of the Difference. This will usually be around 100 counts (3 dB) for a typical antenna configuration. Changes to this parameter may be required based on carrier tracking frequency, possible adjacent satellite, or ambient interference with desired satellite.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.2. EL STEP SIZE

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.3. AZ STEP SIZE

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.4. STEP INTEGRAL

For proper DishScan® operation this parameter **must** be set to factory default value of 0000.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.5. SEARCH INC

Sets size of search pattern increment. Units are in pedestal step resolution (12 steps per degree). The suggested setting is equal to the full 3dB beamwidth of your antenna. Default value is 15 these systems.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.6. SEARCH LIMIT

Sets the overall peak to peak size of the search pattern. Units are in pedestal step resolution (12 steps per degree). Default value is 100 for these systems.

After you have optimized your Targeting (refer to Optimizing Targeting) you may wish to reduce the size of the Search pattern to avoid Tracking on an adjacent satellite (ie set to 50% of its default value so that in the future it will only search half as far from your targeted position).

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.2.7. SEARCH DELAY

Sets the time-out for automatic initiation of a search operation when the signal level (AGC) drops below threshold. Units are in seconds. Range is 0-255 seconds. Default setting is 30 seconds. A setting of 0 disables the automatic search initiation.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

10.2.8. SWEEP INC

This parameter **MUST** be set for the desired azimuth sweep speed of a **No Gyro** search or the sweep increment dimension of an **Inclined Orbit** search (refer to the search pattern information above).

To manually update, press the LEFT arrow key to bring the cursor under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

10.3. **SAVE NEW PARAMETERS**

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

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11. Setup – Blockage & RF Radiation Hazard Zones

This section discusses how to set up blockage, or RF Radiation Hazard, zones in the ACU.

11.1. Radiation Hazard and Blockage Mapping (AZ LIMIT parameters)

The ACU can be programmed with relative azimuth sectors (zones) where blockage exists or where transmit power would endanger personnel who are frequently in that area. Your ACU software may allow you to set four zones or it will only three zones and include +5 volt polarization.

When the AZ LIMIT parameters are set to create these ZONES (up to four), several things happen when the antenna is within one of the zones:

1. Tracking continues as long as the AGC value is greater than the Threshold value. When the AGC value drops below Threshold, the antenna will wait “Search Delay” parameter amount of time and then re-target the satellite you targeted last (if 4 value is included in SYSTEM TYPE). Timeout and re-target will continue until the satellite is re-acquired and tracking can resume.
2. “BLOCKED” will be displayed in the TRACKING window wherever the antenna is inside one of the zones.
3. A contact closure to ground (or an open if the blockage logic is reversed – See SYSTEM TYPE 16 value) is provided on the SW2 terminal of the Terminal Mounting Strip. This Switch output provides a “Blocked”, “RF Radiation Hazard” or “FCC TX Mute” logic output. When the antenna exits the zone it will be on satellite, tracking and the SW2 logic contact closure will open.

The lower and upper limits are user programmable and are stored in NVRAM within the ACU parameter list.

AZ LIMIT 1 is the Lower Relative AZ limit (this is the more counter-clockwise of the two points, even if it is numerically larger). AZ LIMIT 2 is the Upper Relative AZ limit (the more clockwise of the two points) for pattern mapping of ZONE 1. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 12 parameter.

AZ LIMIT 3 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 4 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 2. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 34 parameter.

AZ LIMIT 5 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 6 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 3. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 56 parameter.

AZ LIMIT 7 is the Lower Relative AZ limit (CCW point) and AZ LIMIT 8 is the Upper Relative AZ limit (CW point) for pattern mapping of ZONE 4. Enter the elevation value that represents the top of the blockage between the two azimuth limit points in the EL LIMIT 78 parameter. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.



CAUTION: The **Lower Relative AZ limit** is the more **counter-clockwise** of the two points (even if it is numerically larger) and the **Upper Relative AZ limit** is the more **clockwise** of the two points. If you enter the two relative points incorrectly, Tracking and Searching will be adversely affected.

The ACU provides a contact closure to ground on the SW2 terminal of the Terminal Mounting Strip when the antenna is pointed within any one of the blockage/hazard zones or the system is searching, targeting, unwrapping or is mis-pointed by 0.5 degrees or more (FCC TX Mute function for Transmit/Receive systems **only**). The contact closure is a transistor switch with a current sinking capability of 0.5 Amp. Refer to “Functional Testing” for instructions on how to **simulate** a manual BLOCKED condition to test SW2 logic output.

When used as simple “**BLOCKED**” logic output for a single Sea Tel antenna, this output could be used to light a remote LED and/or sound a buzzer to alert someone that the antenna is blocked, and therefore signal is lost.

In a “Dual Antenna” installation, this logic output is also used to control a Dual Antenna Arbitrator panel to switch the TXIF & RXIF signals from Antenna “A” to Antenna “B” when Antenna “A” is blocked, and vice versa.

When used as simple “**RF Radiation Hazard**” logic output for a single Sea Tel TXRX antenna, this output could be used to suppress RF transmissions while the antenna is pointed where people would be harmed by the transmitted microwave RF power output. The SW2 output would be interfaced to the satellite modem to **disable** the TX output signal from the Satellite TXRX Modem whenever the antenna is within the RF Radiation Hazard zone(s).

When used for “**FCC TX Mute**” logic output for a single Sea Tel TXXR antenna, this output is used to suppress RF transmissions whenever the antenna is mis-pointed 0.5 degrees or more, is blocked, searching, targeting or unwrapping. The SW2 output would be interfaced to the satellite modem to **disable/mute** the TX output signal from the Satellite TXXR Modem. When the mute condition is due to antenna mis-pointing, it will not **un-mute** until the pointing error of the antenna is within 0.2 degrees. The default output is contact closure to ground when the antenna is mis-pointed, therefore providing a **ground** to “Mute” the satellite modem from the SW2 terminal of the Terminal Mounting Strip. If your satellite modem requires an **open** to “Mute”, refer to SYSTEM TYPE parameter 16 value to reverse the output logic from the ACU.

Programming instructions:

Determine the Relative AZ positions **where** blockage, or RF Radiation Hazard, exists. This may be done by monitoring the received signal level and the REL display readings while the ship turns or by graphing the expected blockage pattern. Elevation of the antenna in normal use also must be taken into consideration. A Mast or other structure may cause blockage at low elevation angles, but **may not** cause blockage when the antenna is at higher elevation angles where it is able to look over the structure. Up to four zones may be mapped. Only zones which are needed should be mapped (in AZ LIMIT pairs).

In unlimited antenna systems the Relative position of the antenna must have been calibrated by properly setting the Home Flag Offset (HFO) value in the PCU. The HFO calibrates Relative to display 0000 when the antenna is pointed in-line with the bow of the boat/ship (parallel to the bow).

Convert the relative readings to AZ LIMIT/EL LIMIT values by multiplying by 10. Enter the beginning of the **first** blockage region as AZ LIMIT 1 and the end of the region (clockwise direction from AZ LIMIT 1) as AZ LIMIT 2 parameters in the ACU. If needed, repeat setting AZ LIMIT 3 & 4 for a **second** ZONE and then AZ LIMIT 5 & 6 if a **third** ZONE is needed. All **unneeded** zone AZ LIMIT pairs **must** be set to 0000. Set the upper elevation limit of each blockage zone (also entered in degrees multiplied by 10).

EXAMPLE 1 – Three blockage Zones: A ship has a Sea Tel antenna mounted on the port side and an Inmarsat antenna mounted on the starboard side. A mast forward, the Inmarsat antenna to starboard and an engine exhaust stack aft form the three zones where satellite signal is blocked (as shown in the graphic). In this example zone 1 is caused by the mast, zone 2 is from the Inmarsat antenna, zone 3 is from the stack and zone 4 is not needed:

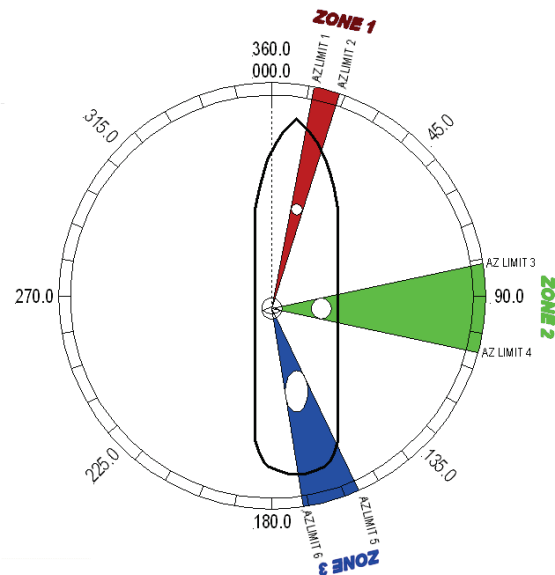
ZONE 1 begins (AZ LIMIT 1) at 12 degrees Relative and ends (AZ LIMIT 2) at 18 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 0120 and AZ LIMIT 2 value of 0180. In this case the mast height only causes blockage up to an elevation of 50 degrees, so we set EL LIMIT 12 to 0500. If the antenna is between these two AZ Limit points but the elevation is greater than 50 degrees, the antenna will no longer be blocked.

ZONE 2 begins (AZ LIMIT 3) at 82 degrees Relative and ends (AZ LIMIT 4) at 106 degrees Relative.

Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 0820 and AZ LIMIT 4 value of 1060. In this case the Inmarsat antenna height only causes blockage up to an elevation of 12 degrees, so we set EL LIMIT 34 to 0120. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 156 degrees Relative and ends (AZ LIMIT 6) at 172 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 1560 and AZ LIMIT 6 value of 1720. In this case the stack antenna height only causes blockage up to an elevation of 36 degrees, so we set EL LIMIT 56 to 0360. If the antenna is between these two AZ Limit points but the elevation is greater than 36 degrees, the antenna will no longer be blocked.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.



EXAMPLE 2 - Three blockage Zones, Dual Antenna

configuration: A ship has 2 Sea Tel antennas, “Antenna A” mounted on the port side and “Antenna B” mounted on the starboard side. Antenna A is designated as the **master** antenna and its zones would be set as in example 1 above. The mast forward, Antenna A to port and the engine exhaust stack aft form the three zones where satellite signal is blocked from Antenna B. The SW2 logic output from Antenna A (ACU A) and Antenna B (ACU B) are used to control a “Dual Antenna Arbitrator”, which will route satellite signal from the **un-blocked** antenna to the other below decks equipment. If both antennas are tracking the same satellite, they will not both be blocked at the same time. The logic output will switch to provide satellite signal to the below decks equipment from Antenna A when it is **not blocked** and will switch to provide satellite signal from Antenna B whenever Antenna A **is blocked**. The switches will not change state if **both** antennas are blocked, or if **both** are on satellite.

Antenna A is the same as the previous example and its ACU would be set to those AZ LIMIT values.

Antenna B ACU would be set to:

In this example Antenna B zone 1 is caused by the stack, zone 2 is from Antenna A, zone 3 is from the mast and zone 4 is not needed.

ZONE 1 begins (AZ LIMIT 1) at 188 degrees Relative and ends (AZ LIMIT 2) at 204 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 1880 and AZ LIMIT 2 value of 2040. In this case the stack height only causes blockage up to an elevation of 42 degrees, so we set EL LIMIT 12 to 0420. If the antenna is between these two AZ Limit points but the elevation is greater than 42 degrees, the antenna will no longer be blocked.

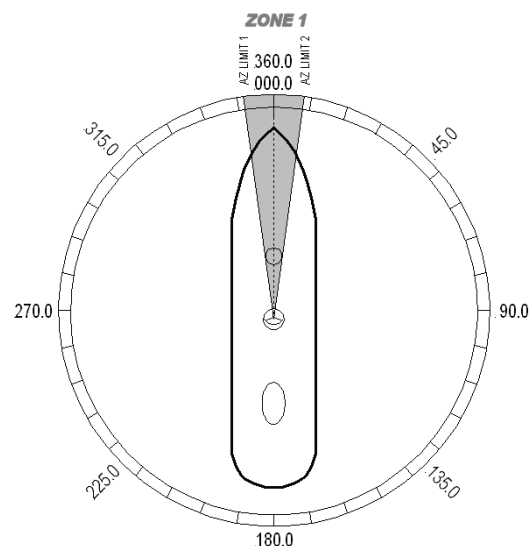
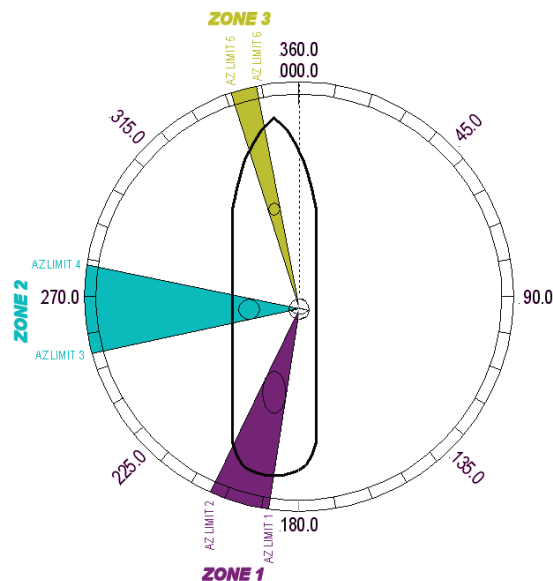
ZONE 2 begins (AZ LIMIT 3) at 254 degrees Relative and ends (AZ LIMIT 4) at 278 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 2540 and AZ LIMIT 4 value of 2780. In this case the Antenna B height only causes blockage up to an elevation of 12 degrees, so we set EL LIMIT 34 to 0120. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 342 degrees Relative and ends (AZ LIMIT 6) at 348 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 3420 and AZ LIMIT 6 value of 3480. In this case the mast height only causes blockage up to an elevation of 41 degrees, so we set EL LIMIT 56 to 0410. If the antenna is between these two AZ Limit points but the elevation is greater than 12 degrees, the antenna will no longer be blocked.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

EXAMPLE 3 - One blockage Zone: A ship has a Sea Tel antenna mounted on the center line of the ship. A mast is forward and an engine exhaust stack is aft. In this example the Stack does **NOT** block the satellite, only the mast forward does. In this example zone 1 is caused by the mast, zone 2, 3 and 4 are not needed:

ZONE 1 begins (AZ LIMIT 1) at 352 degrees Relative and ends (AZ LIMIT 2) at 8 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 3520 and AZ LIMIT 2 value of 0080. In this case the mast height only causes blockage up to an elevation of 52 degrees, so we set EL LIMIT 12 to 0520. If the antenna is between these two AZ Limit points but the elevation is greater than 52 degrees, the antenna will no longer be blocked.



ZONE 2 is not needed. Enter AZ LIMIT 3 value of 0000 and AZ LIMIT 4 value of 0000. Set EL LIMIT 34 to 0000.

ZONE 3 is not needed. Enter AZ LIMIT 5 value of 0000 and AZ LIMIT 6 value of 0000. Set EL LIMIT 56 to 0000.

ZONE 4 is not needed. Enter AZ LIMIT 7 value of 0000 and AZ LIMIT 8 value of 0000. Set EL LIMIT 78 to 0000. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.

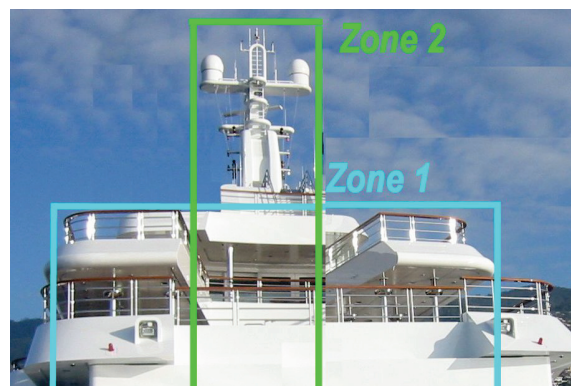
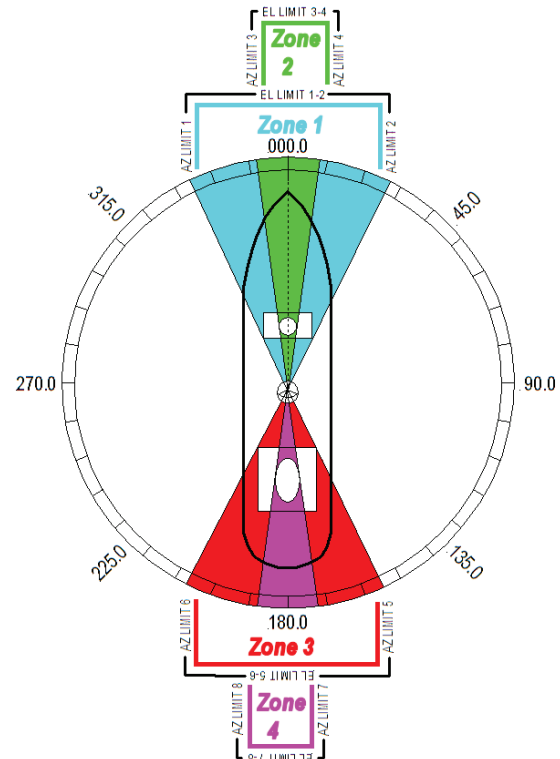
EXAMPLE 4 – Overlaid Blockage Zones: A ship has a Sea Tel antenna mounted on the center line of the ship. A mast mounted on top of a deckhouse (like the picture below) is forward and an engine exhaust stack, also on a deckhouse, is aft. These two blockage areas have wide azimuth blockage at lower elevations and then a narrower azimuth area of blockage extends up to a higher value of elevation.

ZONE 1 begins (AZ LIMIT 1) at 334 degrees Relative and ends (AZ LIMIT 2) at 026 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 1 value of 3340 and AZ LIMIT 2 value of 0260. In this case the mast height only causes blockage up to an elevation of 40 degrees, so we set EL LIMIT 12 to 0400. If the antenna is between these two AZ Limit points but the elevation is greater than 40 degrees, the antenna will no longer be blocked.

ZONE 2 begins (AZ LIMIT 3) at 352 degrees Relative and ends (AZ LIMIT 4) at 008 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 3 value of 3520 and AZ LIMIT 4 value of 0080. In this case the mast height only causes blockage up to an elevation of 70 degrees, so we set EL LIMIT 34 to 0700. If the antenna is between these two AZ Limit points but the elevation is greater than 70 degrees, the antenna will no longer be blocked.

ZONE 3 begins (AZ LIMIT 5) at 155 degrees Relative and ends (AZ LIMIT 6) at 205 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 5 value of 1550 and AZ LIMIT 6 value of 2050. In this case the mast height only causes blockage up to an elevation of 30 degrees, so we set EL LIMIT 56 to 0300. If the antenna is between these two AZ Limit points but the elevation is greater than 30 degrees, the antenna will no longer be blocked.

ZONE 4 begins (AZ LIMIT 7) at 173 degrees Relative and ends (AZ LIMIT 8) at 187 degrees Relative. Multiply these Relative positions by 10. Enter AZ LIMIT 7 value of 1730 and AZ LIMIT 8 value of 1870. In this case the mast height only causes blockage up to an elevation of 55 degrees, so we set EL LIMIT 78 to 0550. If the antenna is between these two AZ Limit points but the elevation is greater than 55 degrees, the antenna will no longer be blocked. If your ACU software includes 5 volt polarization you will not see these AZ & EL LIMIT parameters.



11.2. SAVE NEW PARAMETERS

Parameters that have been changed are only temporarily changed until they are SAVED. If changes are made and not stored, they will still be effective but will be lost when power is removed or the RESET key is pressed. Simultaneously press, and quickly release the LEFT & RIGHT arrow keys to access "SAVE NEW PARAMETERS" directly from any other menu display. Verify that the change(s) you have made is/are correct and then select "SAVE NEW PARAMETERS". Press UP arrow and then ENTER to save any recent changes into the ACUs NVRAM for permanent storage.

12. Setup – Other Parameters

12.1. *SETUP Parameter display and entry menus.*



Press and hold BOTH the LEFT and the RIGHT arrow keys **for 6 seconds** to access to the system setup parameters (at the **EL TRIM** selection). **Press** BOTH the LEFT and the RIGHT arrow keys **momentarily** to access to the **SAVE NEW PARAMETERS** parameter.

Access is only required after installation or repairs of your antenna system. These parameters should only be changed by an authorized service technician.

CAUTION: Improper setting of these parameters will cause your system to not perform properly. Also refer to the SETUP section of your Antenna manual.

12.2. *5V OFFSET (May not be in your software)*

CCW 5v Polang servo position reference. Refer to your antenna manual.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

12.3. *5V SCALE (May not be in your software)*

90 degree 5V Polang servo motion scale factor.

To manually update, press the LEFT arrow key to bring the cursor up under the least significant character. Continue to move the cursor until the desired character to be edited is underscored (selected). Use the UP or DOWN arrow keys to increment or decrement the selected character.

Use the LEFT or RIGHT arrow key to move the cursor left or right to select other characters to modify. When you are finished modifying press ENTER to execute the new value OR press NEXT to abort and exit setup mode.

12.4. *REMOTE COMMAND*

This parameter was used to issue diagnostic commands to the PCU, but is superseded by the use of DacRemP diagnostic software that your dealer will use when necessary.

12.5. *REMOTE MONITOR*

This parameter was used to monitor the results of a diagnostic command which was sent to the PCU.

12.6. *To Disable/Enable DishScan®*

When running a **beam pattern** test, a **programmed sweep** for NOC/Satellite Operator, **balancing** the antenna or **motor diagnostics** where you want the drives (AZ, EL & CL) not to be oscillating you will have to **disable** DishScan®.

Select the DISHSCAN® parameter window on the ACU:

1. Press the **RIGHT** arrow, then press the **UP** arrow and last press the **ENTER** key to turn DishScan® mode ON.
2. Press the **RIGHT** arrow, then press the **DOWN** arrow and last press the **ENTER** key to turn DishScan® Mode OFF.

If you change this remote parameter, you must save the change using **REMOTE PARAMETERS**.

If DishScan® is OFF and the Step Integral parameter is set to 0000, you will get a constant ERROR 0016 (DishScan® error) and you will see zeros flashing in the lower left of the Azimuth and Elevation ENTRY menu displays. This is a visual indication that DishScan® is turned OFF.

Always assure that you **turn DishScan® back ON** when returning to normal operation.

12.7. *Satellite Reference Mode*

The ships gyro compass input to the ACU may be accurate and stable in static conditions and yet may NOT be accurate or stable enough in some underway dynamic conditions. If there is no gyro compass or if the input is corrupt, not stable or not consistently accurate the tracking errors will become large enough to cause the antenna to be mis-pointed off satellite.

Satellite Reference Mode will uncouple the gyro reference from the azimuth rate sensor control loop. When operating in Satellite Reference Mode changes in ships gyro reading will not directly affect the azimuth control loop. The Pedestal Control Unit will stabilize the antenna based entirely on the azimuth rate sensor loop and the tracking information from DishScan®. This will keep the azimuth rate sensor position from eventually drifting away at a rate faster than the tracking loop can correct by using the tracking errors to regulate the rate sensor bias.

Satellite Reference Mode can be used as a diagnostic mode to determine if tracking errors are caused by faulty gyro inputs.

It is normally **OFF** as long as you have good gyro compass input. It **MUST** be **OFF** when the elevation angle is greater than 75 degrees.

Satellite Reference Mode **MUST** be ON when:

- No Gyro Compass is available
- Frequent or constant ACU Error Code 0001 (Gyro Compass has failed)
- Flux Gate Compass is being used

To view, or change, the Satellite Reference Mode status, select the SAT REF remote parameter:

1. Press the RIGHT arrow, then press the UP arrow and last press the ENTER key to turn Satellite Reference Mode ON.
2. Press the RIGHT arrow, then press the DOWN arrow and last press the ENTER key to turn Satellite Reference Mode OFF.

If you change this remote parameter, you must save the change using REMOTE PARAMETERS.

12.8. *REMOTE PARAMETERS*

Allows any remote parameters that have been changed (via Remote Command or Remote Tilt) to be saved. Any REMOTE changes must be saved to NVRAM in the PCU, or they will be lost when power to the antenna is cycled or remote reset command is issued. Press RIGHT arrow and then press ENTER to save the parameters in the remote PCU's NVRAM. A "Parameters Saved" message will be displayed.

13. Stowing the Antenna for Underway with Power OFF

This antenna must be properly stowed if the ship will be underway while AC power to the Above Decks Equipment (ADE) is de-energized. Failure to do so may void your warranty. It is strongly recommended that AC Power to the ADE be supplied from an adequately rated Un-interruptible Power Supply (UPS).



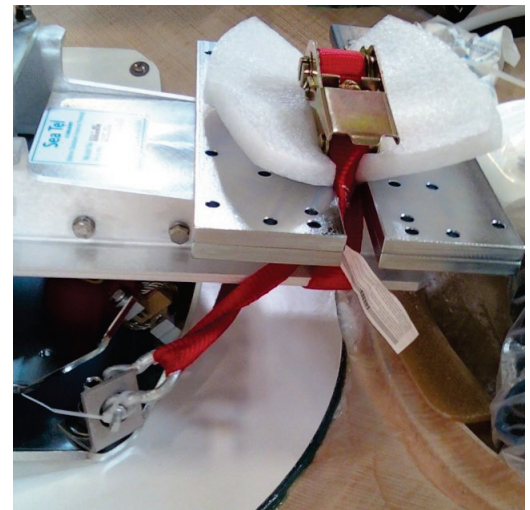
CAUTION: *There are three Stow restraints that **MUST** be installed on this antenna pedestal if the ship will be underway while the Above Decks Equipment is de-energized.*

13.1. Installing the Stow Restraints

The order in which the restraints are installed is not critical.

13.1.1. Installing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To restrain azimuth rotation of the antenna simply thread the strap through one of the clips in the base of the radome.
3. Wrap the strap around the azimuth post toe weight several times.
4. Thread the strap through an adjacent clip.
5. Thread the end of the strap through the buckle above the azimuth post toe weight.
6. Adjust the strap as necessary to enable tightening of the strap. The strap should not be extremely tight. The purpose of the strap is to restrain movement, a small amount of movement is acceptable.
7. Verify that the antenna is not able to rotate in Azimuth.



13.1.2. Installing the EL Shipping/Stow Restraint

1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the un-stowed position the hardware from left to right is Stow pin-bolt head, hex nut, washer, bracket, washer, hex nut so that the pin section of the Stow pin-bolt is **NOT** inserted into the hole in the elevation driven sprocket.

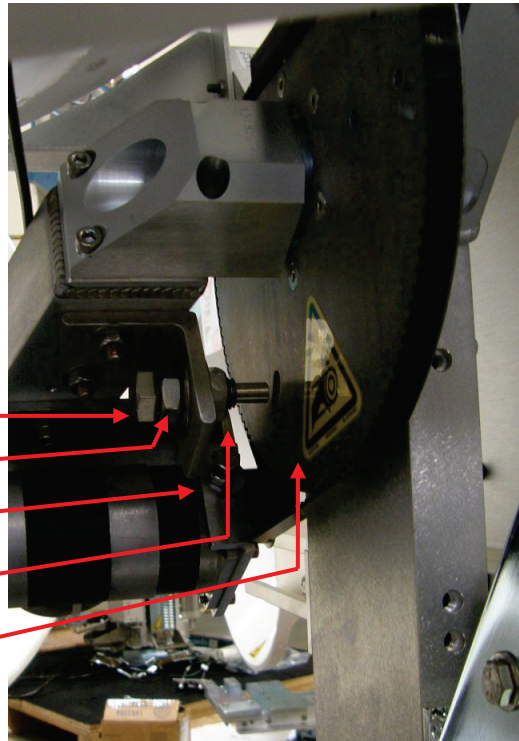
EL Stow Pin-Bolt head

Hex Nut & Washer

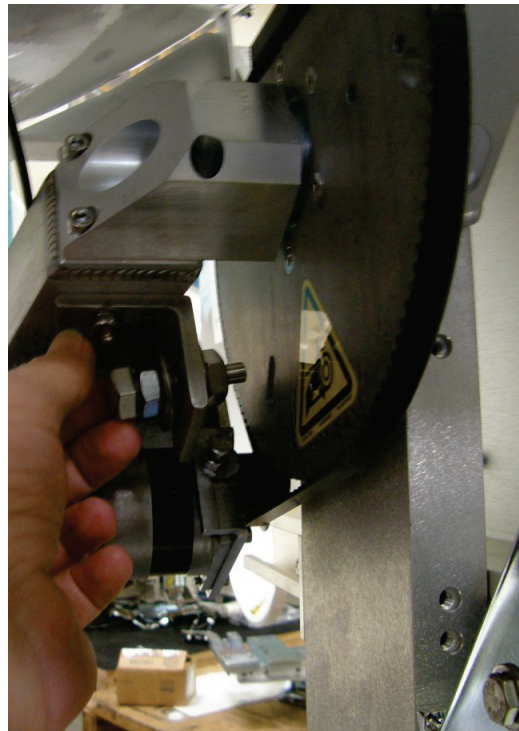
Bracket

Washer & Hex Nut

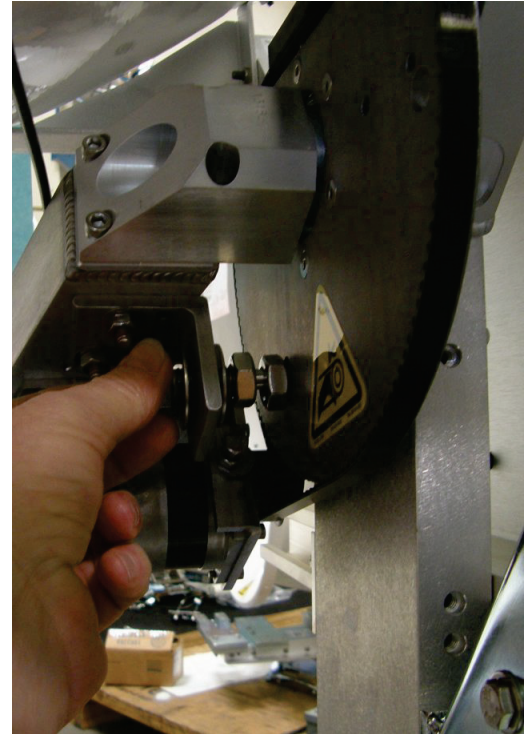
Elevation Driven Sprocket



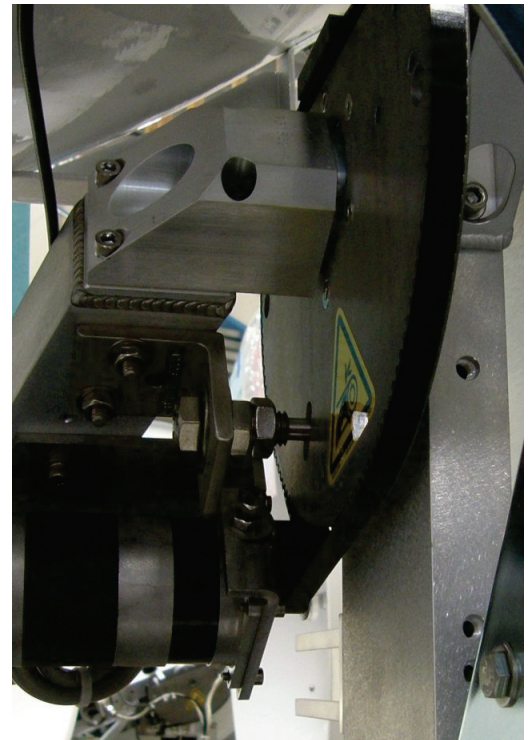
3. To restrain the elevation axis of the antenna, unthread the hex nut nearest the elevation driven sprocket. Remove the hex nut and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



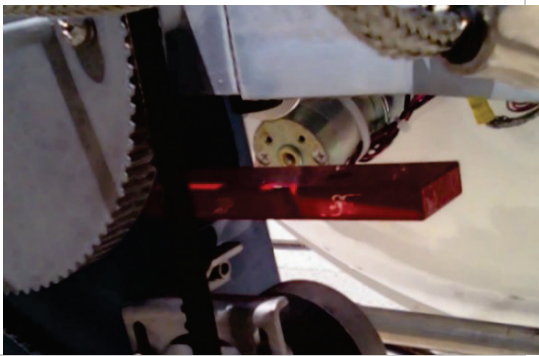
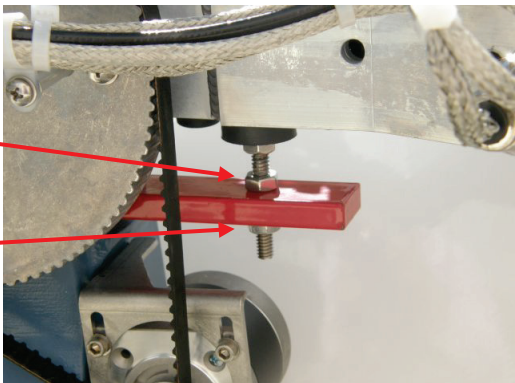
5. Remove the washer from the stow pin-bolt and unthread the hex nut from the bolt.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then thread the 2 hex nuts onto the bolt.



8. Tighten the hex nuts to prevent the hardware from loosening while in the stowed configuration.
9. Verify that the antenna does not rotate in Elevation.



13.1.3. Installing the CL Shipping/Stow Restraint

<ol style="list-style-type: none"> 1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place (at level). 	
<ol style="list-style-type: none"> 2. If not already removed, remove an adjustable bumper, by removing the bottom nut, from one end of the locking bar. 3. If not already loosened, loosen the top nut up toward the rubber bumper. 4. Insert vacant end of the locking bar through the opening under the cross-level beam. 5. Insert the adjustable bumper into the vacant hole on the end of the locking bar. 	
<ol style="list-style-type: none"> 6. To restrain the cross-level axis of the antenna use a 7/16" open end wrench to tighten the nut on the top side of the locking bar until the rubber bumper is forced up against the bottom of the cross-level beam. 7. Verify that the antenna does NOT rotate (tilt left & right from level). 8. Re-install and tighten the bottom nut on the under side of the locking bar. 	

13.2. **Removing the Shipping/Stow Restraints PRIOR to Power-Up**

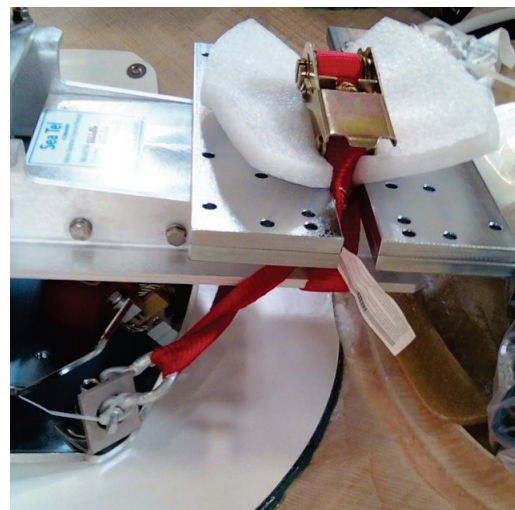
The order in which the restraints are removed is not critical.



CAUTION: There are three shipping/Stow restraints on this antenna pedestal that **MUST** be removed, **before energizing** the antenna, for normal operation.

13.2.1. Removing the AZ Shipping/Stow Restraint

1. The AZ Shipping/Stow restraint is formed by a buckle web strap wound around the azimuth post toe weight and passed through stow clips in the base of the radome.
2. To un-restrain azimuth rotation of the antenna simply untie/unbuckle the web strap and remove it from the azimuth post and clips.
3. Save the web strap so that the antenna can be restrained in the future should it be required.
4. Verify that the antenna rotates freely and easily a full 360 degrees CW & CCW in Azimuth.

**13.2.2. Removing the EL Shipping/Stow Restraint**

1. The EL Shipping/Stow restraint is formed by a Stow pin-bolt mounted through a bracket and is engaged into a hole/slot in the elevation driven sprocket when the dish is at zenith (90 degrees elevation).
2. In the stowed position the hardware from left to right is Stow pin-bolt head, washer, bracket, washer, hex nut, hex nut so that the pin section of the Stow pin-bolt is inserted into the hole in the elevation driven sprocket.

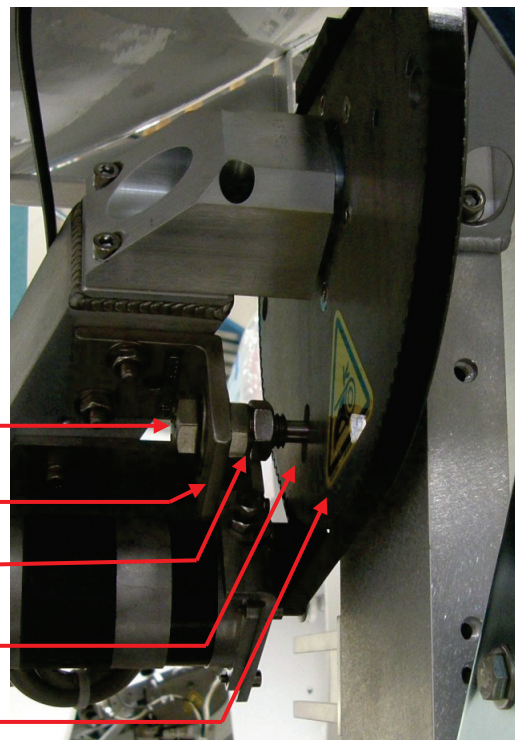
EL Stow Pin-Bolt head

Bracket

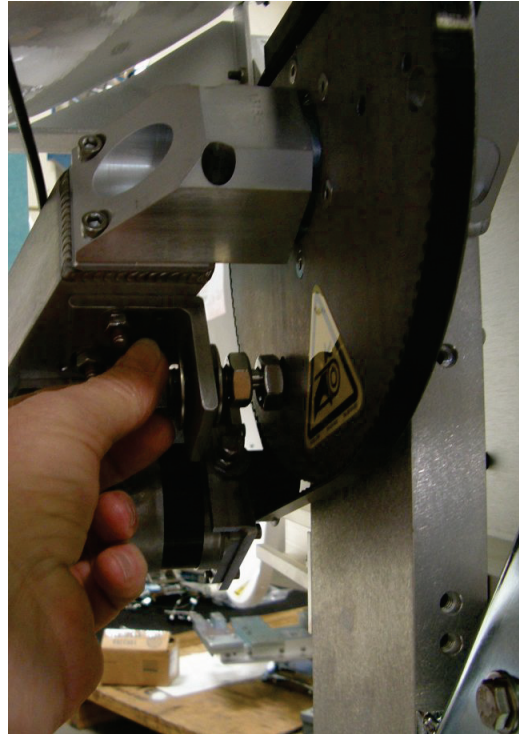
2 Hex Nuts

Pin inserted into Elevation Driven Sprocket

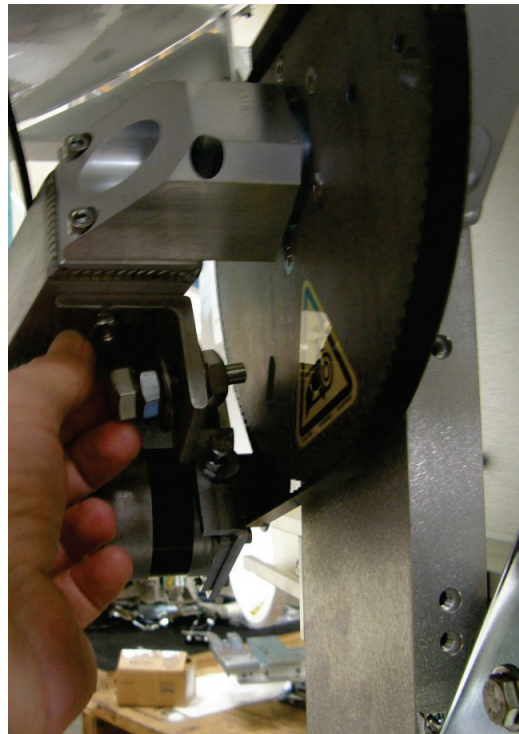
Elevation Driven Sprocket



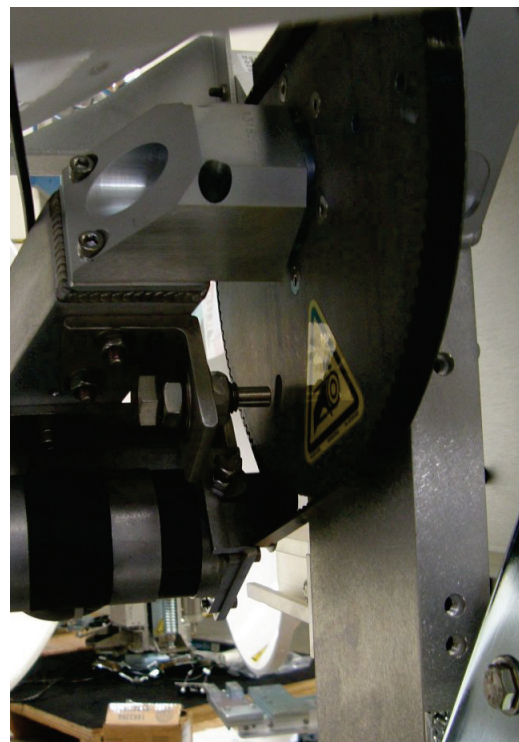
3. To un-restrain the elevation axis of the antenna, unthread the two hex nuts. Remove the hex nuts and washer from the stow pin-bolt.
4. Remove the stow pin-bolt from the bracket.



5. Remove the washer from the stow pin-bolt and thread one of the 2 hex nuts onto the bolt and tighten.
6. Put one of the washers onto the stow pin-bolt and insert it into the bracket toward the elevation driven sprocket.
7. Put the other washer, and then the other hex nut onto the bolt.



8. Tighten the hex nut to prevent the hardware from loosening while in the un-stowed configuration.
9. Verify that the antenna rotates freely through its full elevation range of motion.



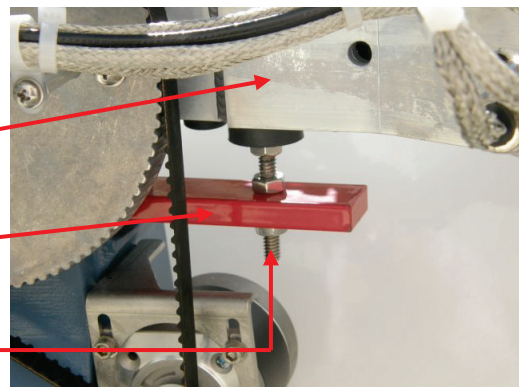
13.2.3. Removing the CL Shipping/Stow Restraint

1. The CL Shipping/Stow restraint is formed by a red locking bar with adjustable bumpers at each end of the bar. This mechanism is placed under the cross-level beam to lock it in place.

Cross-Level Beam

CL Shipping/Stow bar

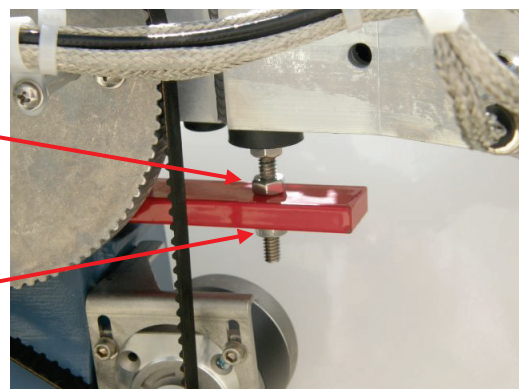
Adjustable CL Locking Bumpers (only one end shown)



2. To un-restrain the cross-level axis of the antenna use a 7/16" open end wrench to loosen the nut on the top side of the locking bar (either end of the bar).

3. Remove the bottom nut off of that adjustable bumper.

4. Remove the adjustable bumper from the locking bar.



<ol style="list-style-type: none">5. Extract the locking bar from the underside of the cross-level beam and retain these parts for later re-use if it becomes necessary to stow the antenna.6. Verify that the antenna rotates (tilts left & right from level) freely through its full cross-level range of motion.	
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14. DAC-2202 Technical Specifications

The technical specifications for the DAC-2202 ACU and some of the specifications for general Below Decks are:

14.1. DAC-2202 Antenna Control Unit

The technical specifications for the DAC-2202 ACU are:

14.1.1. General

Physical Dimensions:	Rackmount: 1.75" x 17" x 14"
Input Voltage:	110/220 VAC, 50/60 Hz
Power Requirements:	160 Watts maximum
Weight	2.8 kg (6.2 lbs)

14.1.2. Front Panel

Status Indicator Display:	6 LED annunciators for Tracking, Searching, Target, Power, Initializing, and Error
Alpha Numeric Display:	2 Line 20 Character Alpha Numeric
Next Button	Cycles display between Ship, Satellite, Antenna, and Status
4-Position Keypad	Cycles cursor Up / Down / Left / Right
Enter Button	Submits currently entered value to RAM
Reset Button	Soft Reset of the Antenna Control Unit ONLY (does not reset ADE)
Controls:	AC Power On/Off

14.1.3. Rear Panel

Connectors:

J1 "Ship Gyro"	25 pin female D-Subminiature
J2 "NMEA" RS-422 Serial I/O	9 pin male D-Subminiature
J3 "M&C" RS-422 Serial I/O	9 pin female D-Subminiature
J4A "Antenna" RS-422	9 pin female D-Subminiature
Pedestal M&C	
J4B "Antenna" Control IF and Pedestal DC Power	Type F female
J6 "RF IN" Tracking Receiver IF Input	Type F female
J7 "RF OUT" Tracking Receiver IF Output	Type F female
"Ethernet"	RJ-45
"AC Input Power 95-250VAC"	IEC receptacle

14.1.4. J4A "Antenna" Pedestal M&C Interface

Communications Parameters:	9600 Baud, 8 bits, No parity, 1Stop Bit
Interface Protocol:	Full Duplex RS-422
Base Modem Power:	30 Volts DC
Interface Connector:	9 pin male D-Subminiature

14.1.5. J4B “Antenna” Pedestal M&C Interface

Communications Parameters:	9600 Baud, 8 bits, No parity, 1Stop Bit
Interface Protocol:	Full Duplex FSK Modulated at 70 KHz (TX) & 120 KHz (RX)
Antenna Power:	30 Volts DC
Interface Connector:	Type F female

14.1.6. J3 “M&C” Aux Serial Interface

Communications Parameters:	9600 Baud, 8 bits, No parity, 1Stop Bit
Interface Protocol:	Optically Isolated RS-422/RS232
Interface Connector:	DE9S

14.1.7. J2 “NMEA A” Interface

Communications Parameters:	(Selectable) 4800 Baud, 8, N, 1
Interface Protocol	Optically isolated RS-422 Receive RS-232 Transmit (Pseudo GGA echo sentence)
Interface Connector	DE9P
NMEA GPS Sentence:	xxGLL typically GPGLL or LCGLL
NMEA Heading Sentence:	xxHDT or xxHDM typically HCHDM or HCHDT

14.1.8. J2 “NMEA B” Interface

Communications Parameters:	(Selectable) 4800 Baud, 8, N, 1
Interface Protocol	Optically isolated RS-422 Receive
Interface Connector	DE9P
NMEA GPS Sentence:	xxGLL typically GPGLL or LCGLL
NMEA Heading Sentence:	xxHDT or xxHDM typically HCHDM or HCHDT

14.1.9. Ethernet

Interface Protocol	10BaseT
Interface Connector	RJ-45
Interface Ports	2 TCP M&C (Ports 2000, 2001) 1 UPD Upload (Port 3000) 1 Multi-User HTML (Port 80)

14.1.10. L-Band SCPC Narrow Band Tracking Receiver**Internal Satellite Identification Receiver**

Tuning range	950 to 2150 MHz in 1 KHz increments.
Input RF Level	-85 to -25 dBm typical
Output RF Level	Input level +/- 1 dB typical
Sensitivity	30 mV / dB typical
Bandwidth	300 KHz
Polarity switching	13 VDC output to select Vertical or RHCP polarity. 18 VDC to output select Horizontal or LHCP polarity
Band Switching:	22kHz continuous tone output to select High band, No tone to select Low band.

14.2. Terminal Mounting Strip

14.2.1. Synchro Interface:

Connectors	5 screw terminal connections
Input Voltage Level	36-110 VDC, 400 or 60 hertz
Synchro Ratios	1:1, 36:1, 90 or 180:1 and 360:1 with Synchro-Digital converter 360:1 with Synchro-SBS converter
Impedance:	1M ohm

14.2.2. SBS Interface

Connectors	4 screw terminal connections
Input Voltage Level	20-90 VDC
Interface	Opto-Isolated,
Polarity	Auto switching
Ratio	6 steps per degree
Impedance:	10K ohm

14.2.3. Control Interface

14.2.3.1. *External AGC*

External AGC or Satellite Modem Lock Input.

Connections	2 screw terminal connections (AGC and GND)
Voltage Level:	0-5 VDC
Impedance:	30K ohm
Control:	Low Level (<1.25Vdc) = Modem Lock* High Level (>1.25Vdc) = Modem Unlock*

*The logic sense of the external Satellite Modem Lock input can be reversed by adding 128 to the SYSTEM TYPE Parameter.

14.2.3.2. *SW1 Local Band Select Output*

Control local (BDE) band select switch(s) or tone generator(s).

Connections	1 screw terminal connection (SW1)
Control Level:	Low Band = OPEN circuit High Band = SHORT to ground Controlled by MODE – TRACKING – Band Selection. Current sink of 0.5 amps max

14.2.3.3. *SW2 Blockage / TX Mute Output*

Blockage output to Dual Antenna Arbitrator coax switch panel OR TX Mute output to Satellite Modem for RF radiation hazard and/or FCC compliance.

Connections	1 screw terminal connection (SW2)
Control Level:	Not Blocked or Not mispointed = OPEN circuit* Blocked or mispointed = SHORT to ground * Current sink of 0.5 amps max

*The logic level output can be reversed by adding 16 to the SYSTEM TYPE parameter.

14.2.4. NMEA Interface

This interface allows up to two simultaneous external GPS or NMEA 0183 compliant Heading inputs and an echoed GPS (Alternating GPGGA and GPGLL) output and is connected to the ACU via ribbon cable(s).

Connections	5 Screw terminal connections (RXA+ / RXA- input, RXB+ / RXB-input, and TXA+ output)
Rx Sentence Format:	Global Positioning System \$xxGGL,DDmm.mmmm,N,DDDmm.mmmm,W (,UTC <i>optional</i>) (*CS <i>optional</i>) <cr> Heading \$xxHDT,xxx.x <cr>
Tx Sentence Format	Global Positioning System \$GPGGA,0,DDmm,N,DDDmm,W <cr> <lf>

14.3. Environmental Conditions

The following requirements apply to equipment installed in weather protected locations.

Temperature	0 to 40 degrees C
Humidity	Up to 100% @ 40 degrees C, Non-condensing

14.4. DAC-2202 AC Power Consumption

Voltage:	100-240 VAC, 1 Phase
Cycle:	47-63Hz
Power:	160 Watts (max)

14.5. Cables**14.5.1. IF Signal Cables**

Please refer to the "Antenna L-Band IF Coax Cables" section of the specification chapter of your antenna manual for coaxial cable recommendations.

14.5.2. SBS/Synchro Gyro Compass Interface Cable (Customer Furnished)

Type:	Multi-conductor, Shielded
Number of wires	4 Conductors for Step-By-Step Gyro, 5 Conductors for Synchro
Wire Gauge:	18 AWG
Insulation:	600 VAC

15. ST60-2 TVRO Technical Specifications

The specifications of your antenna system are below. *For Naval Engineering level information on this subject, please refer to Antenna Installation Guideline – Site Arrangement, document number 130040_A available on the Sea Tel Dealer Support Site.*

15.1. Antenna Assembly - 60" C-Band TVRO

The antenna assembly is comprised of the Dish, feed assembly and LNB. A variety of LNBs could be used, refer to LNB specification for the LNB that is provided with your system:

Reflector Diameter	1.5 m (58 inch)
Reflector Type	Spun Aluminum axis symmetric D Ring focus
Feed	Ring focus Cassegrain feed with integral S-Band radar filter and Dual Polarity TVRO OMT
Port to Port Isolation	> 35 dB typical
Polarization	Dual Circular LHCP & RHCP
Polarization control	Manual Normal/Reverse Select
Receive frequency range	3.7-4.2 GHz C-Band
Antenna RX Gain	33.3 dBi at 3.7 GHz Typical
Antenna Efficiency	65 Percent typical minimum
C-Band LNB(s)	
Receive Frequency:	3.7-4.2 GHz
IF Frequency:	950-1450 MHz
LO Frequency:	5.15 GHz
Noise Figure	25 deg C, typical

15.2. MK 2 Pedestal Control Unit (PCU)

The PCU Assembly contains 3 Printed Circuit Boards (PCBs).

Connectors	
AC Power	100-240 VAC, 2A-1A
USB	Mini USB
GPS Input	RJ-11 connector
Motor Control	DA-15S connector
70/140 MHz	SMA (on 4 ch Modem) 70/140 MHz input
Rotary Joint	SMA
L-Band	SMA L-Band input
RF M&C	DE-9S connector
Feed	DB-25S connector
Service	DE-9S connector
Coax Switch	
J2/NO/Co-Pol	SMA
J3/COM/Common	SMA
J1/NC/Cross-Pol	SMA
Controls	None
M&C Interface	9600 Baud 400MHz FSK
Status LEDs	
PCU Status	Diagnostic Status of the PCU
Modem Status	Configuration & Diagnostic Status of the Modem

15.3. 400 MHz Base & Pedestal Unlimited Azimuth Modems (3 Channel)

Combined Signals (-1,-2)

Pass-Thru

950-3200 MHz RX IF,

Injected

22Khz Tone

DC LNB Voltage Select

400 MHz Pedestal M&C

Connectors:

RX IF L-Band

SMA female

Rotary Joint

SMA female

Radio / Ped M&C

9 pin D-Sub Connectors

RF Pedestal M&C

Pedestal Control

Modulation

FSK

Mode

Full Duplex

Frequencies

BDE RF M&C

TX = 447.5 Mhz +/-100 KHz

BDE Ped M&C

TX = 452.5 Mhz +/-100 KHz

ADE RF M&C

TX = 460.0 Mhz +/-100 KHz

ADE Ped M&C

TX = 465.0 Mhz +/-100 KHz

Radio/Pedestal M&C

Radio & Pedestal Control

Modulation

FSK

Mode

Full Duplex

Diagnostics

LED Status Indicator for Power, Link communications and Self Test

Pedestal Interface

RS-232/422

RF Interface (Jumper Selectable)

RS-232, RS-422 (4 wire) or RS-485 (2 wire)

ADE/BDE Mode

Jumper Selectable

15.4. MK 2 Motor Driver Enclosure (MDE)

The Motor Driver Enclosure contains the Motor Driver for the 3 Brushless DC Drive motors (AZ/EL/CL) and the Brake Controller for the EL & CL motors.

Connectors

Drive

DA-15P connector

Home

DE-9S connector

AZ

DA-15S connector

EL

DA-15S connector

CL

DA-15S connector

Status LEDs

CL Drive

EL Drive

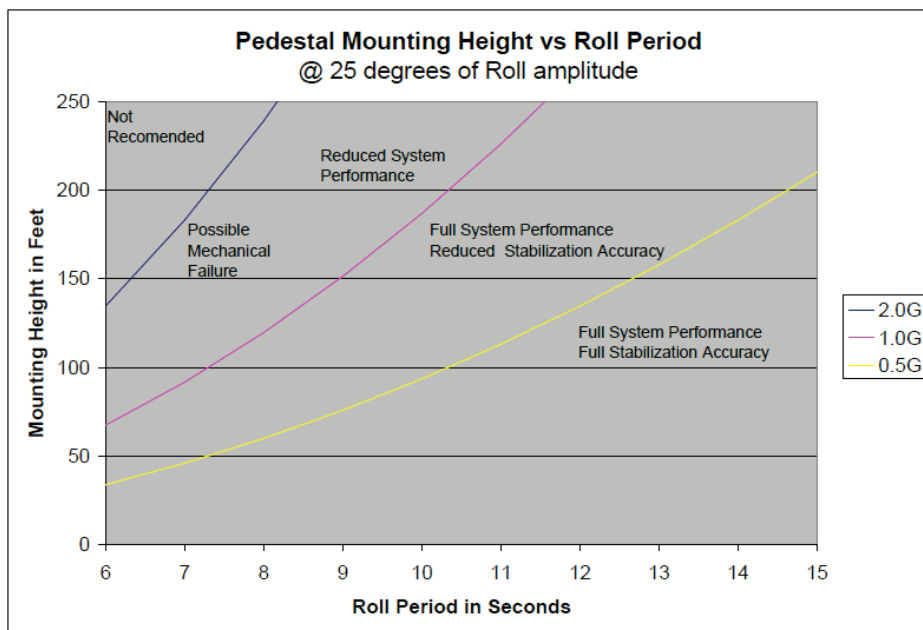
AZ Drive

MDE Status

15.5. Stabilized Antenna Pedestal Assembly

Type:	Three-axis (Level, Cross Level, AZ)
Stabilization:	Torque Mode Servo
Stab Accuracy:	0.1 degrees RMS, 0.2 degrees MAX in presence of specified ship motions (see below).
Azimuth Motor:	Size 23 Brushless DC Servo w/ Encoder
Level and Cross Level Motors:	Size 23 Brushless DC Servo w/ Brake
Inertial Reference:	3 Solid State Rate Sensors
Gravity Reference:	3 axis solid state accelerometer
AZ transducer:	256 line optical encoder / home switch
Pedestal Range of Motion:	
Elevation	-15 to +115
Cross Level (Inclined 30 degrees)	+/- 35 degrees
Azimuth	Unlimited
Elevation Pointing	
20 deg Roll	+5 to +90 degrees
25 deg Roll	+10 to +90 degrees
Maximum Ship Motions	
Roll:	+/-24.7 degrees at 8 sec periods
Pitch:	+/- 15 degrees at 6 sec periods
Yaw:	+/-8 degrees at 15 sec periods
Turning rate:	Unlimited
Headway:	Up to 50 knots
Heave / Surge / Sway	0.5G
Specified Ship Motions (for stabilization accuracy tests):	
Roll	+/- 20 degrees at 8 second period
Pitch	10 degrees FIXED
AZ Relative	0, 45, & 90 degrees with respect to roll input
Mounting height:	Sea Tel recommends that you not exceed tangential accelerations of 0.5 G (See chart below).

For Naval Engineering level information on this subject, please refer to Antenna Installation Guideline – Site Arrangement, document number 130040 available on the Sea Tel Dealer Support Site.



15.6. Radome Assembly, 76"

Type	Frequency Tuned
Material	Composite foam/laminate
Size	
Diameter:	201.59cm (79.37 inch)
Height:	200.99cm (79.13 inch)
Hatch size	18" x 28"
Installed weight	MAX 233.6 kg (515 lbs.) Including antenna pedestal.
RF attenuation	Less than 0.3 dB @ 10.7-12.75 GHz, dry Less than 0.3 @ 14.0-14.5 GHz, dry
Wind:	Withstand relative average winds up to 201 Kmph (125 mph) from any direction.
Ingress Protection Rating	All Sea Tel radomes have an IP rating of 56

Maintenance – The radome must be kept clean and free of residues that will increase the RF attenuation.

Repair - NOTE: Damage to the seal of the inside, or outside, of the radome can allow moisture to be absorbed. This will result in de-lamination of the radome, increased weight and higher attenuation.

To maintain the RF transparency characteristics of the radome top, any cracks, scratches or other damage to the surface seal of the tuned radome top must be repaired and re-sealed by a competent "A" layered laminate, or cored deck, repair professional.

Cracks in, or other damage to, the radome base can be repaired using typical fiberglass repair techniques and proper sealing of the inside and outside surfaces. Edges of holes in the radome base must be properly sealed to prevent moisture from being absorbed into the layered construction of the radome base.

Disposal - Should it ever become necessary to dispose of the radome, it must be disposed of using the same handling procedures as other fiberglass materials.

15.7. ADE Pedestal Power Requirements:

Antenna AC Input Power	100-240 VAC, 47-63 Hz, single phase
Antenna Power Consumption	450 Watts MAX (brake release, pedestal drive and 8W BUC drive)

15.8. XX09 Environmental Specifications**15.8.1. Climatic Conditions**

Environmental condition	Test Level
Temperature Range (Operating)	-25° to +55° Celsius (-13° to +131° F)
Humidity	100% Condensing
Wind Speed (relative)	56 m/sec (125 mph)
Solar Radiation	1,120 Watts per square meter, 55° Celsius
Icing:	Survive ice loads of 1.2g per square cm (4.5 pounds per square foot). Degraded RF performance will occur under icing conditions.
Rain:	Up to 101.6mm (4 inches) per hour. Degraded RF performance may occur when the radome surface is wet.

15.8.2. Chemically Active Substances

Environmental Condition	Test Level
Sea Salt	5 percent solution

15.8.3. Mechanical Conditions

Environmental Condition	Test Level			
Systematic Vibration Amplitude Acceleration Frequency Range	5.0 millimeters 2.0 G (20 m/s ²) 1Hz-150 Hz			
Shock (Transient Vibration) Response Spectrum Peak Accel., m/s ² Duration, ms Number of Cycles Directional Changes	I 100 11	II 300 6	III 500 3	
	3 each direction 6			
Shock (Bump) Peak Accel., m/s ² Duration, ms Number of Cycles Directional Changes	250 6 100 ea. direction 6			

15.8.4. Transit Conditions

Environmental Condition	Test Level
Drop (Transit Shock)	30 G @ 8 inches

15.9. Below Decks Equipment**15.9.1. Antenna Control Unit (ACU)**

Refer to the information in the Specifications chapter of this Manual.

15.9.2. Terminal Mounting Strip (TMS)

Refer to the information in the Specifications chapter of this Manual.

15.9.3. Satellite Receiver

Please refer to the manufacturers I&O manual for this device.

15.9.4. Multiswitch

Please refer to the manufacturers I&O manual for this device.

15.10. *Cables***15.10.1. Antenna Control Cable (Provided from ACU to the Base MUX)**

RS-422 Pedestal Interface

Type	Shielded Twisted Pairs
Number of wires	6
Wire Gauge	24 AWG or larger
Communications Parameters:	9600 Baud, 8 bits, No parity
Interface Protocol:	RS-422
Interface Connector:	DE-9P

15.10.2. Antenna L-Band TVRO IF Coax Cables (Customer Furnished)

2, 4 or 6 cables are required dependant upon which feed/LNB configuration your antenna is fitted with.

Type F male connectors installed on the cables MUST be the correct type so that they mate properly with the cable you are using.

Due to the dB losses across the length of the RF coaxes at L-Band, Sea Tel recommends the following 75 ohm coax, or Heliax, cable types (and their equivalent conductor size) for our standard pedestal installations:

Run Length	Coax Type	Conductor Size
up to 75 ft	LMR-300-75	18 AWG
up to 150 ft	RG-11 or LMR-400-75	14 AWG
up to 200 ft	LDF4-75 Heliax	10 AWG
Up to 300 ft	LMR-600-75	6 AWG

For runs longer than 300 feet, Sea Tel recommends Single-mode Fiber Optic Cables with Fiber Optic converters.

15.10.3. Multi-conductor Cables (Customer Furnished)

Due to the voltage loss across the multi-conductor cables, Sea Tel recommends the following wire gauge for the AC & DC multi-conductor cables used in our standard pedestal installations:

Run Length	Conductor Size
up to 50 ft	20 AWG (0.8 mm)
up to 100 ft	18 AWG (1.0 mm)
up to 150 ft	16 AWG (1.3 mm)
up to 250 ft	14 AWG (1.6 mm)
Up to 350 ft	12 AWG (2.0 mm)

16. DRAWINGS

The drawings listed below are provided as a part of this manual for use as a diagnostic reference.

16.1. DAC-2202 Antenna Control Unit Drawings

Drawing	Title	
125411-1_R	DAC-2202 w/ DVB Rackmount General Assembly	16-3
125411-3_R	DAC-2202 w/ SCPC Rackmount General Assembly	16-5

16.2. ST60-2 Model Specific Drawings

Drawing	Title	
133646-1_A1	System, ST60-2 in 76" Radome	16-10
133645-1_A1	System Block Diagram, ST60-2	16-12
133644-1_A1	Assembly Schematic	16-15
131790_A	Pedestal Schematic	16-16
134119-1_A	Antenna Assembly, ST60-2	16-17
132539_A	Monuting Assembly, PCU	16-19
133655-1_A1	EL/CL Balance Weight Kit, ST60-2	16-21
133659-1_A	76" Radome Assembly	16-23
125749_D	Installation Arrangement, 76"	16-26
131226_A	Procedure, Radome Strain Relief Installation	16-27

16.3. Series 09 General Drawings

Drawing	Title	
121628-4_R	Terminal Mounting Strip	16-33
129710-1_B2	Base Multiplexer Panel	16-35

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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	124265	G	ENCLOSURE, 1U RACKMOUNT, DAC-2200 SER	
2	1 EA	122300	F	LID, DAC-2200 SERIES ENCLOSURE	
5	1 EA	120385-2	C	BRACKET, LID, ACU ASS'Y, 4-40 PEM	
7	1 EA	122445	B1	FRONT PANEL ASS'Y, DAC-2202	
9	1 EA	122307-1	K	DVB RECEIVER ASS'Y, STD ACU	
11	1 EA	124813-1	R	PCB ASS'Y, DAC-2202 ACU	
16	1 EA	114836	B2	PCB ASS'Y, S/D CONVERTER, 12 BIT	
17	1 EA	123046-3	D	HARNESS, DC POWER	
18	1 EA	133562-6	A	POWER SUPPLY, SWITCHER, COTS	
19	1 EA	112646-13	F6	PCB ASS'Y, DC-DC CONVERTER, 13V	
21	1 EA	122660-4	G	HARNESS, AC ENTRY, SINGLE	
24	1 EA	112918-9	D	CABLE ASS'Y, RIBBON, 20 PIN	
25	1 EA	120740	A1	CABLE ASS'Y, DVB RECEIVER	
30	1 EA	123070	A1	DECAL, HIGH VOLTAGE WARNING	
41	8 EA	110941-3	B	SCREW, JACK, 4-40 X .312 LG	
42	1 EA	114587-106		SCREW, RND HD, PHIL, 4-40X1/4, S.S	
44	7 EA	114588-144		SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S.	
45	6 EA	114576-106		SCREW, FLAT HD, PHIL, 4-40 x 1/4, S.S	
46	1 EA	114588-146		SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S.	
47	1 EA	114580-007		WASHER, FLAT, #6, S.S.	
49	4 EA	119967	A1	NUT, HEX, PANEL, 3/8-32	
50	3 EA	126264-13	A1	WASHER, STAR, INTERNAL TOOTH, NARROW	
58	1 EA	120090-17	C1	MICRO ASS'Y, 12-BIT SDC	
65	2 EA	119745-120		SCREW, PAN HD, PHIL, M3 X 10	
68	8 EA	127956-2	A	NUT, HEX KEPS, 6-32, S.S.	
69	1 EA	124791	A1	LABEL CAUTION, MICROWAVE HAZARD	
71	2 EA	120077-116		SCREW, FLAT HD, PHIL, M3 X 6, S.S.	
72	2 EA	120077-118		SCREW, FLAT HD, PHIL, M3 X 8, S.S.	

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DAC-2202, DVB RCVR, COAX IF

PROD FAMILY COMMON	EFF. DATE 7/9/2012	SHT 1 OF 2	DRAWING NUMBER 125411-1	REV R
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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
73	1 EA	125193	1.16	SOFTWARE, DAC-2202 ACU, COMM_IF	
74	1 EA	124871	6.08 h	SOFTWARE, DAC-2202 ACU, GP32, STD	
76	1 EA	108929-2	D	POWER CORD, 110V AC	(NOT SHOWN) ,
77	1 EA	109752-3	C	POWER CORD, 220V AC	(NOT SHOWN) ,
78	1 EA	110959-1	C4	DECAL, SERIAL NUMBER/PATENT, SMALL	
79	5 EA	115697-2	B	CABLE TIE MOUNT, .75 X .75 X .18, ABM	
80	5 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
81	3 EA	110924-1	A	JUMPER, .100 SPACING, 2 POS, CLOSED	

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DAC-2202, DVB RCVR, COAX IF				
PROD FAMILY COMMON	EFF. DATE 7/9/2012	SHT 2 OF 2	DRAWING NUMBER 125411-1	REV R

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	124265	G	ENCLOSURE, 1U RACKMOUNT, DAC-2200 SER	
2	1 EA	122300	F	LID, DAC-2200 SERIES ENCLOSURE	
5	1 EA	120385-2	C	BRACKET, LID, ACU ASS'Y, 4-40 PEM	
7	1 EA	122445	B1	FRONT PANEL ASS'Y, DAC-2202	
9	1 EA	127166-1	D1	SCPC RECEIVER ASS'Y, ACU / PCU, V5	
11	1 EA	124813-1	R	PCB ASS'Y, DAC-2202 ACU	
16	1 EA	114836	B2	PCB ASS'Y, S/D CONVERTER, 12 BIT	
17	1 EA	123046-3	D	HARNESS, DC POWER	
18	1 EA	133562-6	A	POWER SUPPLY, SWITCHER, COTS	
19	1 EA	112646-13	F6	PCB ASS'Y, DC-DC CONVERTER, 13V	
21	1 EA	122660-4	G	HARNESS, AC ENTRY, SINGLE	
24	1 EA	112918-9	D	CABLE ASS'Y, RIBBON, 20 PIN	
25	1 EA	120740	A1	CABLE ASS'Y, DVB RECEIVER	
30	1 EA	123070	A1	DECAL, HIGH VOLTAGE WARNING	
41	8 EA	110941-3	B	SCREW, JACK, 4-40 X .312 LG	
42	1 EA	114587-106		SCREW, RND HD, PHIL, 4-40X1/4, S.S	
44	7 EA	114588-144		SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S.	
45	6 EA	114576-106		SCREW, FLAT HD, PHIL, 4-40 x 1/4, S.S	
46	1 EA	114588-146		SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S.	
47	1 EA	114580-007		WASHER, FLAT, #6, S.S.	
49	4 EA	119967	A1	NUT, HEX, PANEL, 3/8-32	
50	3 EA	126264-13	A1	WASHER, STAR, INTERNAL TOOTH, NARROW	
58	1 EA	120090-17	C1	MICRO ASS'Y, 12-BIT SDC	
65	2 EA	119745-120		SCREW, PAN HD, PHIL, M3 X 10	
68	8 EA	127956-2	A	NUT, HEX KEPS, 6-32, S.S.	
69	1 EA	124791	A1	LABEL CAUTION, MICROWAVE HAZARD	
71	2 EA	120077-116		SCREW, FLAT HD, PHIL, M3 X 6, S.S.	
72	2 EA	120077-118		SCREW, FLAT HD, PHIL, M3 X 8, S.S.	

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DAC-2202, SCPC RCVR, 9 WIRE IF

PROD FAMILY COMMON	EFF. DATE 7/9/2012	SHT 1 OF 2	DRAWING NUMBER 125411-3	REV R
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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
73	1 EA	125193	1.16	SOFTWARE, DAC-2202 ACU, COMM_IF	
74	1 EA	124871	6.08 h	SOFTWARE, DAC-2202 ACU, GP32, STD	
76	1 EA	108929-2	D	POWER CORD, 110V AC	(NOT SHOWN) ,
77	1 EA	109752-3	C	POWER CORD, 220V AC	(NOT SHOWN) ,
78	1 EA	110959-1	C4	DECAL, SERIAL NUMBER/PATENT, SMALL	
79	5 EA	115697-2	B	CABLE TIE MOUNT, .75 X .75 X .18, ABM	
80	5 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
81	3 EA	110924-1	A	JUMPER, .100 SPACING, 2 POS, CLOSED	

<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
DAC-2202, SCPC RCVR, 9 WIRE IF				
PROD FAMILY COMMON	EFF. DATE 7/9/2012	SHT 2 OF 2	DRAWING NUMBER 125411-3	REV R

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C

B

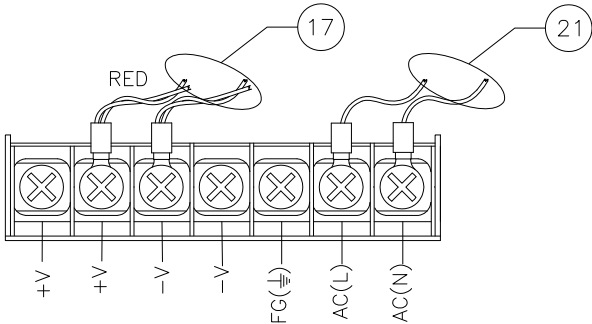
A

NOTES, UNLESS OTHERWISE SPECIFIED:

1. APPLY ADHESIVE PER SEA TEL SPEC 121730.
2. LOCATE LABEL, APPROX. WHERE SHOWN.
3. INSTALLED JUMPERS:
JP2 1-2
JP3 SEE DASH TABLE
JP4 1-2
4. IDENTIFY FPI PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX.
WHERE SHOWN.
5. IDENTIFY ACU PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX. WHERE SHOWN.
6. IDENTIFY RECEIVER ASS'Y P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX.
WHERE SHOWN.
7. IDENTIFY S/D CONVERTER PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX.
WHERE SHOWN.
8. IDENTIFY DC / DC CONVERTER PCB P/N, REV AND S/N PER SEATEL SPEC 122930 APPROX.
WHERE SHOWN.
9. IDENTIFY PER SEA TEL SPEC 122930 APPROX. WHERE SHOWN.
10. NOTE ORIENTATION OF IC & PCB AS SHOWN.
11. IDENTIFY DAC S/N PER SEA TEL SPEC 122930.
12. ALL PCB ASSY & REWORK SHALL COMPLY WITH IPC-A-610 REV. D.
13. PROGRAM & TEST PER SEA TEL SPEC 126883.
14. ROUTE ALL HARNESSES AND CABLE ASSEMBLIES PER SEA TEL SPEC. 121872.
15. PAGE 2, WIRE AS SHOWN IN PICTURE #1 FOR COSEL POWER SUPPLY, PICTURE #2
FOR THE MAEANWELL POWER SUPPLY; MAINTAINING WIRE SEPARATION AS INDICATED.

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
J	6746	6/29/09	ADD -12. ADD APPLICATION COLUMN IN DASH TABLE.	SL
J1	NONE	2/04/10	UPDATE -12 TO INDICATE 9 WIRE NOT COAX.	HT
K	7095	2/05/10	-8 & SHEETS 2 & 3 ADDED; BASH TABLE UPDATED	MSF
L	7350	7/14/10	DASH 8 ONLY, ITEM 73 WS 125193; ITEM 50 WS QTY 3	K.D.H.
M	8148	11/30/10	ITEM 18 WAS 125343-6. ITEM 65 WAS 120452-32.	SL
M1	9213	2/01/12	UPDATE NOTE 5 IN SHEET 3 BY REMOVING TEXT "ITEM 50" AFTER "DETECTOR".	SL
N	8857	3/02/12	ADDED NOTES 14 & 15 AND UPDATED WIRING DRAWING.	KRB
P	9363	04/24/12	UPDATE DVB/SCPC TUNER FAB.	SL
Q	9555	04/25/12	NEW FAB CORRECTED TRACE ROUTING FOR 70KHz MODEM IN P/N 124813-1	MSF
R	9803	6-21-12	ITEM 72 WAS QTY 4; ADD ITEM 71	K.D.H.

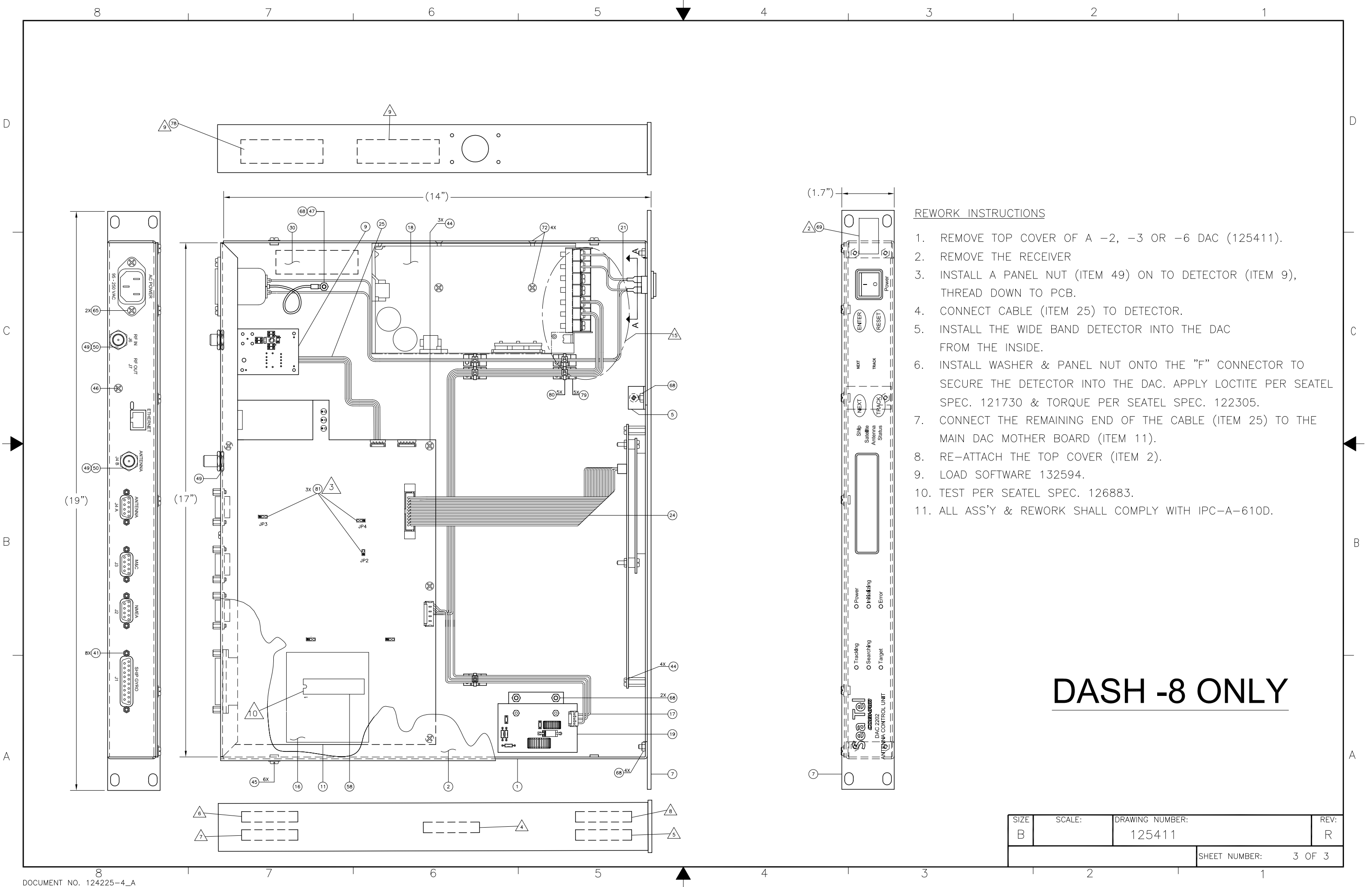
DASH	APPLICATION	RECEIVER	ANTENNA	JP3	SHEET #
-1	TVRO	DVB	COAX	2-3	2
-2	TXRX	DVB	9 WIRE	1-2	2
-3	TXRX	SCPC	9 WIRE	1-2	2
-4	USAT	SCPC	COAX	2-3	2
-6	DAC	NBIF	9 WIRE	1-2	2
-7	DAC	NBIF	COAX	2-3	2
-8	POLAR TRACK	720MHz	9 WIRE	1-2	3
-12	TAC-C	DVB	9 WIRE	1-2	2



VIEW A-A
SCALE: 2:1
POWER SUPPLY CONNECTIONS

REFERENCE DRAWINGS:
126881 WIRING DIAGRAM, DAC 2202

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994	DESIGNER/ENGINEER:	DRAWN BY: LAE		<div>Sea Tel</div> <div><i>COBHAM</i></div> <div>Tel. 925-798-7979 Fax. 925-798-7986</div>	
	WEIGHT:	DRAWN DATE: 5/17/08			
	MATERIAL: N/A	APPROVED BY:		TITLE: DAC 2202 RACKMOUNT ASS'Y	
	FINISH: N/A	APPROVED DATE:			
Sea Tel - Strictly Confidential & Proprietary. Do Not Copy, Distribute or Disclose Without Prior Written Approval From Sea Tel. Copyright © Sea Tel, Inc 2011 - Unpublished Work	SURFACE ROUGHNESS:	SIZE B	SCALE: NONE	DRAWING NUMBER 125411	REV R
	3rd ANGLE PROJECTION	FIRST USED:			SHEET NUMBER 1 OF 3



REWORK INSTRUCTIONS

1. REMOVE TOP COVER OF A -2, -3 OR -6 DAC (125411).
2. REMOVE THE RECEIVER
3. INSTALL A PANEL NUT (ITEM 49) ON TO DETECTOR (ITEM 9), THREAD DOWN TO PCB.
4. CONNECT CABLE (ITEM 25) TO DETECTOR.
5. INSTALL THE WIDE BAND DETECTOR INTO THE DAC FROM THE INSIDE.
6. INSTALL WASHER & PANEL NUT ONTO THE "F" CONNECTOR TO SECURE THE DETECTOR INTO THE DAC. APPLY LOCTITE PER SEATEL SPEC. 121730 & TORQUE PER SEATEL SPEC. 122305.
7. CONNECT THE REMAINING END OF THE CABLE (ITEM 25) TO THE MAIN DAC MOTHER BOARD (ITEM 11).
8. RE-ATTACH THE TOP COVER (ITEM 2).
9. LOAD SOFTWARE 132594.
10. TEST PER SEATEL SPEC. 126883.
11. ALL ASS'Y & REWORK SHALL COMPLY WITH IPC-A-610D.

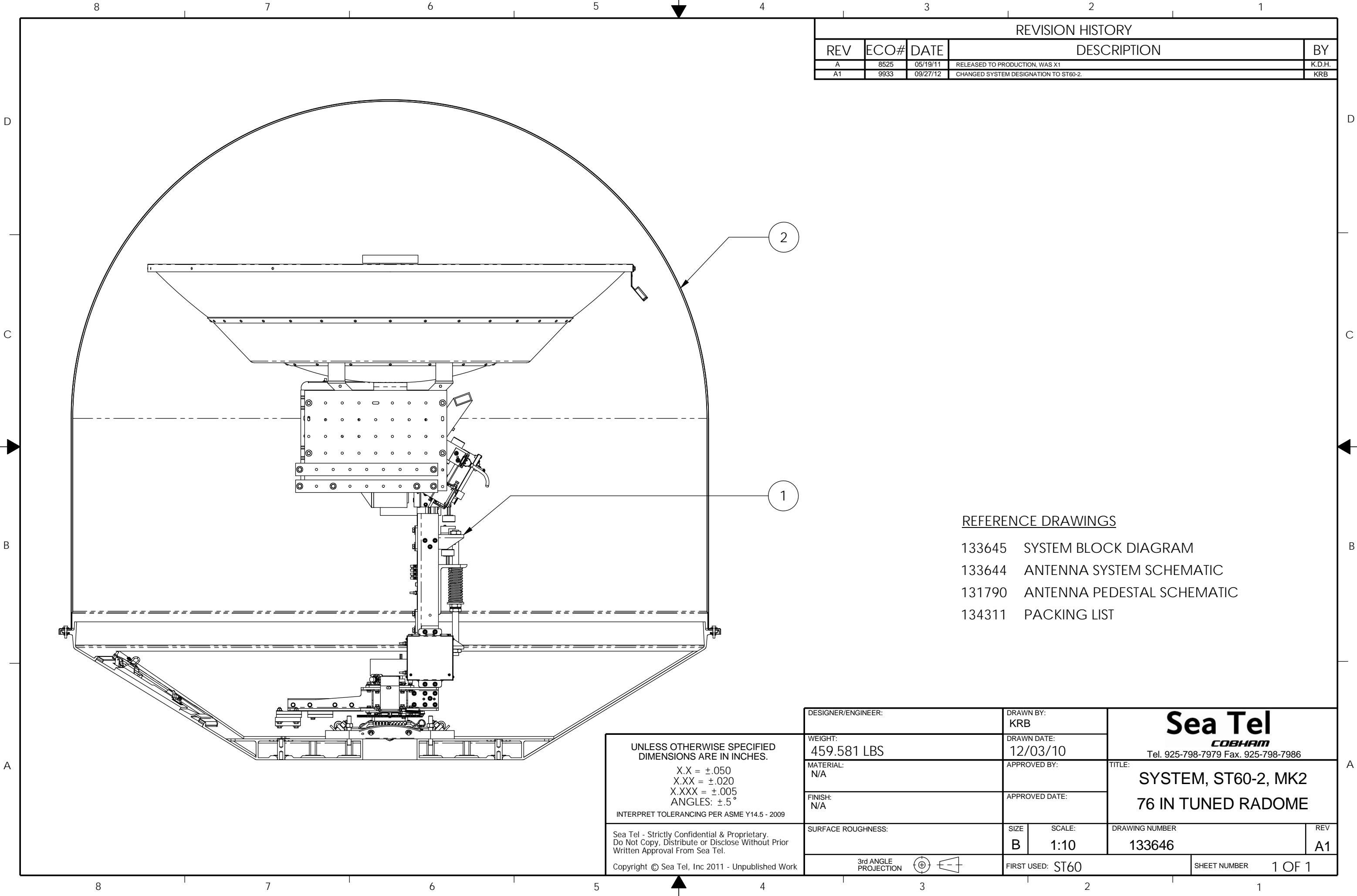
DASH -8 ONLY

SIZE B	SCALE:	DRAWING NUMBER: 125411	REV: R
SHEET NUMBER:			3 OF 3

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	133647-1	B1	GENERAL ASS'Y, ST60, CIRCULAR, C-BAND	
2	1 EA	133659-1	A	RADOME ASS'Y, GA INSTALL, 76 IN, WHIT	
6	1 EA	125411-3	R	DAC-2202, SCPC RCVR, 9 WIRE IF	
7	1 EA	129615-1	B	BELOW DECK KIT, L-BAND, 400MHZ, RS-23	
9	1 EA	133658	A	CUSTOMER DOC PACKET, 6009/11 TVRO	
11	1 EA	124766-1	B	DECAL KIT, 66-81 IN RADOME, SEA TEL	
12	1 EA	121711	A	BALANCE WEIGHT KIT	
13	1 EA	130290-1	B1	SHIP STOWAGE KIT, XX09	

<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
SYSTEM, ST60-2, CIRCULAR, C BAND				
PROD FAMILY 6009	EFF. DATE 9/28/2012	SHT 1 OF 1	DRAWING NUMBER 133646-1	REV A1



REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	8525	05/19/11	RELEASED TO PRODUCTION, WAS X1	K.D.H.
A1	9933	09/27/12	CHANGED SYSTEM DESIGNATION TO ST60-2.	KRB

REFERENCE DRAWINGS

- 133645 SYSTEM BLOCK DIAGRAM
- 133644 ANTENNA SYSTEM SCHEMATIC
- 131790 ANTENNA PEDESTAL SCHEMATIC
- 134311 PACKING LIST

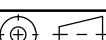
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.

X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°

INTERPRET TOLERANCING PER ASME Y14.5 - 2009

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DESIGNER/ENGINEER:		DRAWN BY: KRB		<div>Sea Tel</div> <div>COBHAM</div> <div>Tel. 925-798-7979 Fax. 925-798-7986</div> <div>TITLE: SYSTEM, ST60-2, MK2 76 IN TUNED RADOME</div>	
WEIGHT: 459.581 LBS		DRAWN DATE: 12/03/10			
MATERIAL: N/A		APPROVED BY:			
FINISH: N/A		APPROVED DATE:			
SURFACE ROUGHNESS:		SIZE B	SCALE: 1:10	DRAWING NUMBER 133646	REV A1
3rd ANGLE PROJECTION 		FIRST USED: ST60			SHEET NUMBER 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	133647-1	B1	GENERAL ASS'Y, ST60, CIRCULAR, C-BAND	
4	1 EA	134121-1	A	FEED ASS'Y, CIRCULAR, C BAND, 60 IN,	
5	2 EA	134164-1	A	LNB, C-BAND, DRO, 8225RF	
20	1 EA	132956-1	D	CIRCUIT BREAKER BOX ASS'Y, 6 AMP	
21	1 EA	131057-1	H	ENCLOSURE ASS'Y, PCU, 09G2, 3 CH, 232	
22	1 EA	131227-1	D	ENCLOSURE ASS'Y, MOTOR DRIVER, 09G2	
23	1 EA	121951-3	F1	MOTOR, SZ 23, BLDC, 2 STK W/ ENCODER,	
24	2 EA	125644-1	H1	MOTOR, SIZE 23, BLDC W/ BRAKE, 15 PIN	
26	1 EA	131381-1	C	GPS ANTENNA, SERIAL	
27	1 EA	129543-24	C	KIT, CABLE ASS'Y AND PROXIMITY SENSOR	
31	1 EA	129526-84	C	HARNESS ASS'Y, PCU TO MOTOR DRIVER, X	
32	1 EA	129527-36	B	HARNESS ASS'Y, MOTOR TO ELEVATION, 36	
40	1 EA	129254-2	A3	POWER RING, 20A, 3 CIRCUITS, XX09	
41	1 EA	127583-64	A1	CABLE ASS'Y, PEDESTAL, AC POWER, 4006	
42	1 EA	124288-12	H	CABLE ASS'Y, AC POWER, 12 IN	
50	2 EA	128385-60BLK	C	CABLE ASS'Y, RG-179, COAX, SMA (RA) T	
52	1 EA	114972-3	N1	CABLE ASS'Y, SMA(M) - SMA(M), 84 IN	
53	2 EA	114972-4	N1	CABLE ASS'Y, SMA(M) - SMA(M), 30 IN	
60	2 EA	115492-1	C8	ADAPTER, N(F)-SMA(F), W/FLANGE	
61	1 EA	116466	F1	ROTARY JOINT, 4.5 GHz, DUAL COAX.	
62	2 EA	110567-14	D	ADAPTER, N(F)-F(M), STRAIGHT	
100	1 EA	125411-3	R	DAC-2202, SCPC RCVR, 9 WIRE IF	
101	1 EA	129615-1	B	BELOW DECK KIT, L-BAND, 400MHZ, RS-23	
102	1 EA	129710-1	B2	BASE MUX RACK PANEL ASS'Y, 400MHZ, RS	
103	1 EA	121628-4	R	ASSEMBLY, TERMINAL MOUNTING STRIP	
105	1 EA	129613-2	E1	MODEM ASS'Y, 400MHZ, 3 CH, BDE, RS 23	
110	1 EA	113303-10	V	CABLE ASS'Y, SMA 90 - SMA (M), 9 IN	
111	1 EA	115384-3	E2	CABLE ASS'Y, SMA(M)-BNC(M), 72 IN.	

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SYSTEM BLOCK DIAGRAM, ST60-2

PROD FAMILY LIT	EFF. DATE 9/28/2012	SHT 1 OF 2	DRAWING NUMBER 133645-1	REV A1
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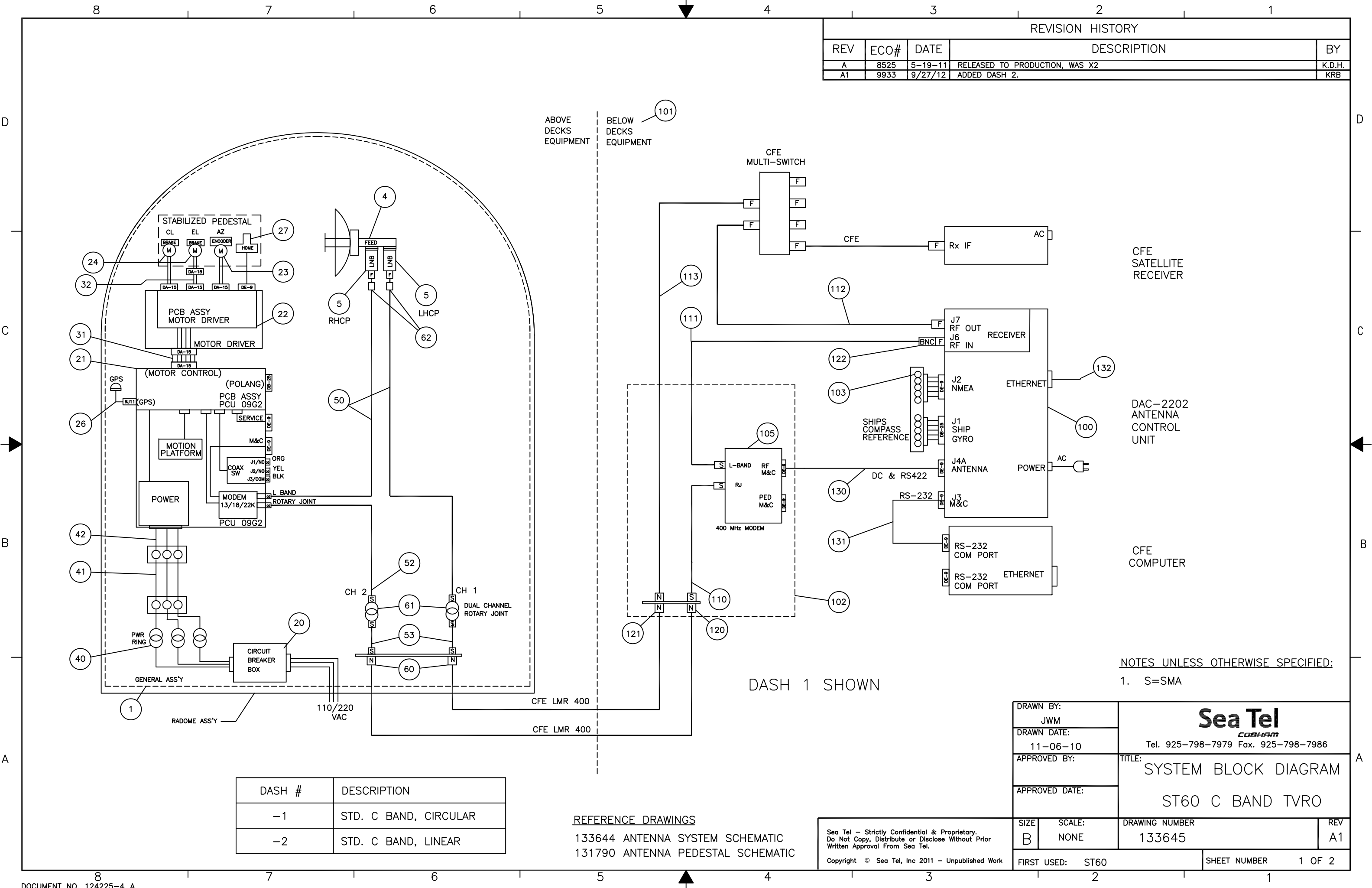
SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
112	1 EA	111115-6	B1	CABLE ASS'Y, F(M)-F(M), 6 FT.	
113	1 EA	116700-6	F	CABLE ASS'Y, RG223, N(M)-F(M), 6 FT.	
120	1 EA	115492-1	C8	ADAPTER, N(F)-SMA(F), W/FLANGE	
121	1 EA	110567-19	D	ADAPTER, N(F)-N(F), STRAIGHT, FLANGE	
122	1 EA	111003-18	C	ADAPTER, BNC(F)-F(M)	
130	1 EA	116298-1	G	INTERFACE HARNESS ASS'Y, SINGLE MODEM	
131	1 EA	120643-25	B	CABLE ASS'Y, RS232, 9-WIRE, STRAIGHT,	
132	1 EA	119479-10	B1	CABLE ASS'Y, CAT5 JUMPER, 10 FT.	

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COBHAM

SYSTEM BLOCK DIAGRAM, ST60-2

PROD FAMILY LIT	EFF. DATE 9/28/2012	SHT 2 OF 2	DRAWING NUMBER 133645-1	REV A1
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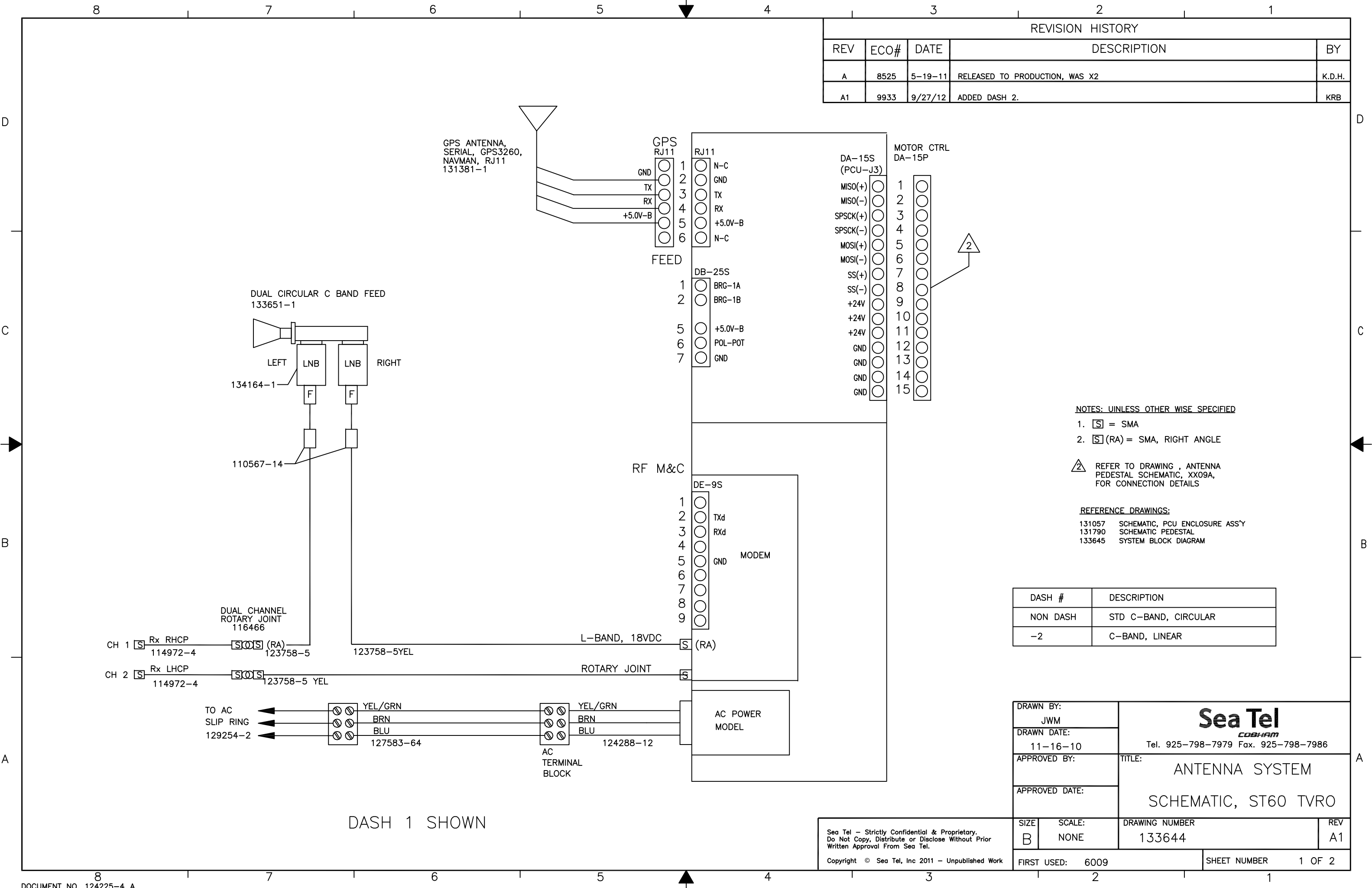


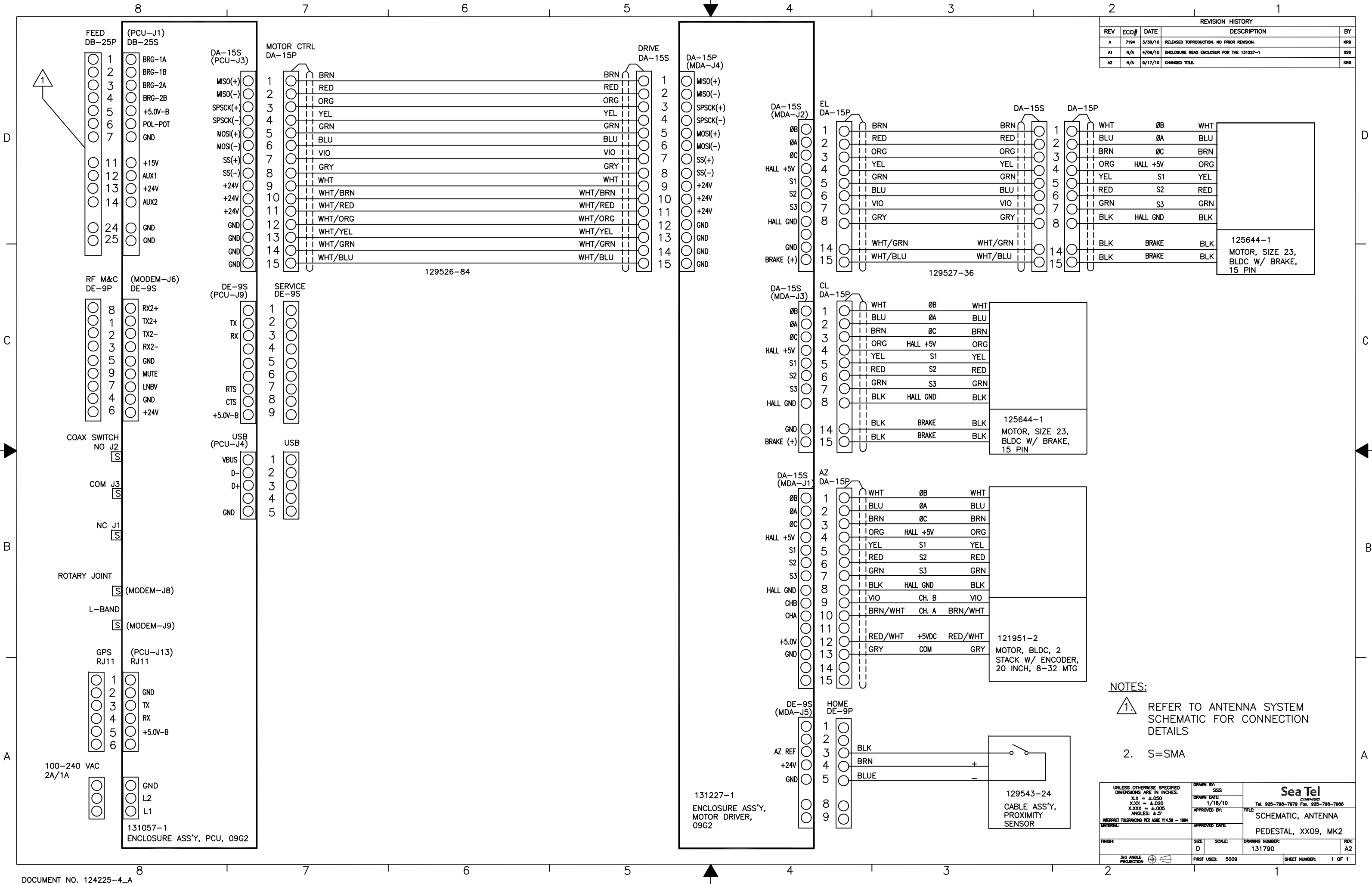
REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	8525	5-19-11	RELEASED TO PRODUCTION, WAS X2	K.D.H.
A1	9933	9/27/12	ADDED DASH 2.	KRB

DASH #	DESCRIPTION
-1	STD. C BAND, CIRCULAR
-2	STD. C BAND, LINEAR

REFERENCE DRAWINGS
133644 ANTENNA SYSTEM SCHEMATIC
131790 ANTENNA PEDESTAL SCHEMATIC

Sea Tel COBHAM		Tel. 925-798-7979 Fax. 925-798-7986	
DRAWN BY: JWM		TITLE: SYSTEM BLOCK DIAGRAM	
DRAWN DATE: 11-06-10		ST60 C BAND TVRO	
APPROVED BY:		DRAWING NUMBER 133645	
APPROVED DATE:		REV A1	
SIZE B	SCALE: NONE	FIRST USED: ST60	
		SHEET NUMBER 1 OF 2	

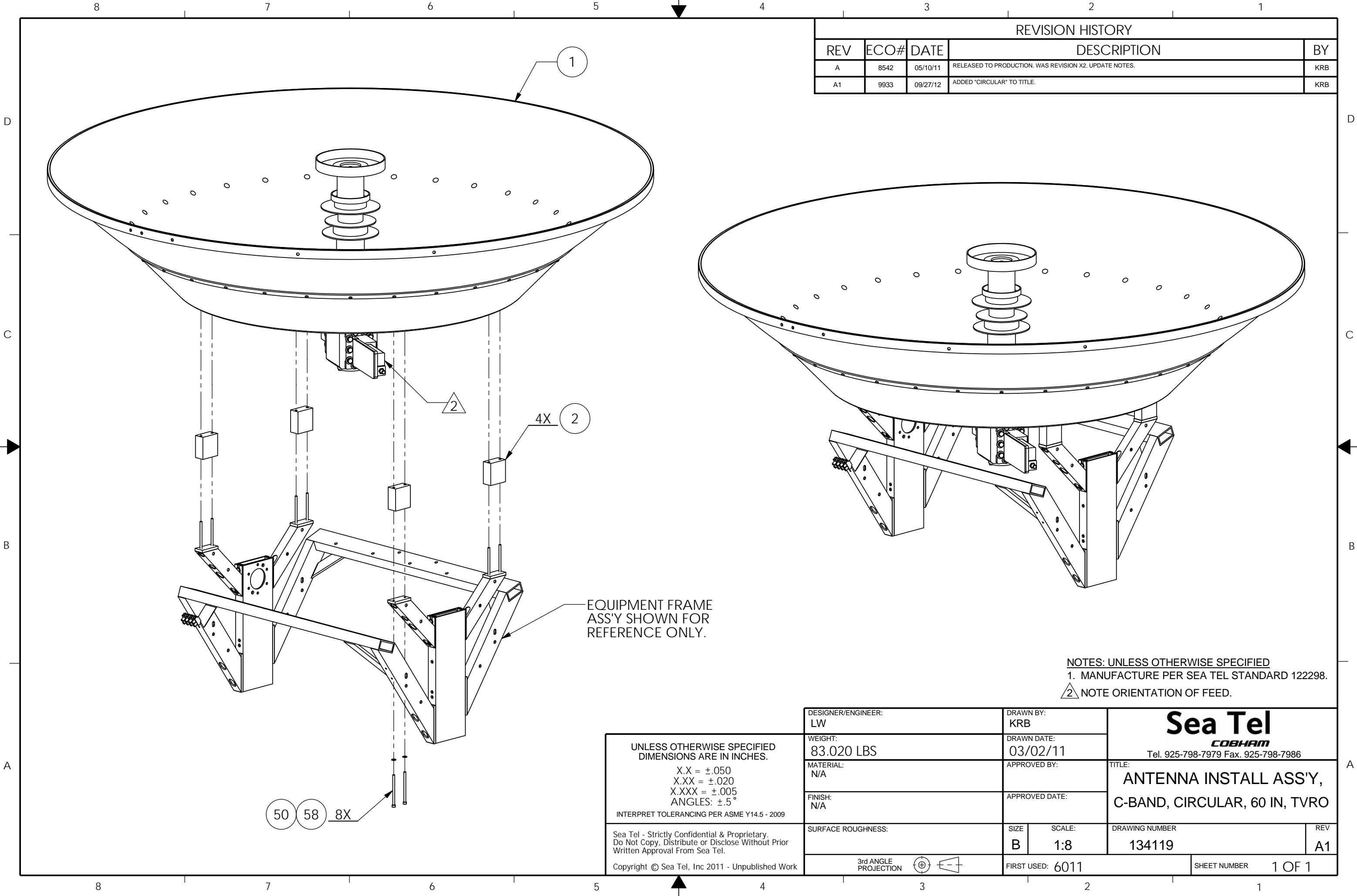




SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	134184-1	A	ANTENNA ASS'Y, CIRCULAR, C BAND, 60	
2	4 EA	125488-1	B2	SPACER, REFLECTOR BRACE, 2.190 IN	
50	8 EA	132028-11300	A	SCREW, SOCKET HD, GRADE 8 STANDARD 10	
58	8 EA	114580-011		WASHER, FLAT, #10, S.S.	

<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
ANTENNA INSTALL ASS'Y, C-BAND, 60 IN, TVRO				
PROD FAMILY COMMON	EFF. DATE 9/28/2012	SHT 1 OF 1	DRAWING NUMBER 134119-1	REV A1

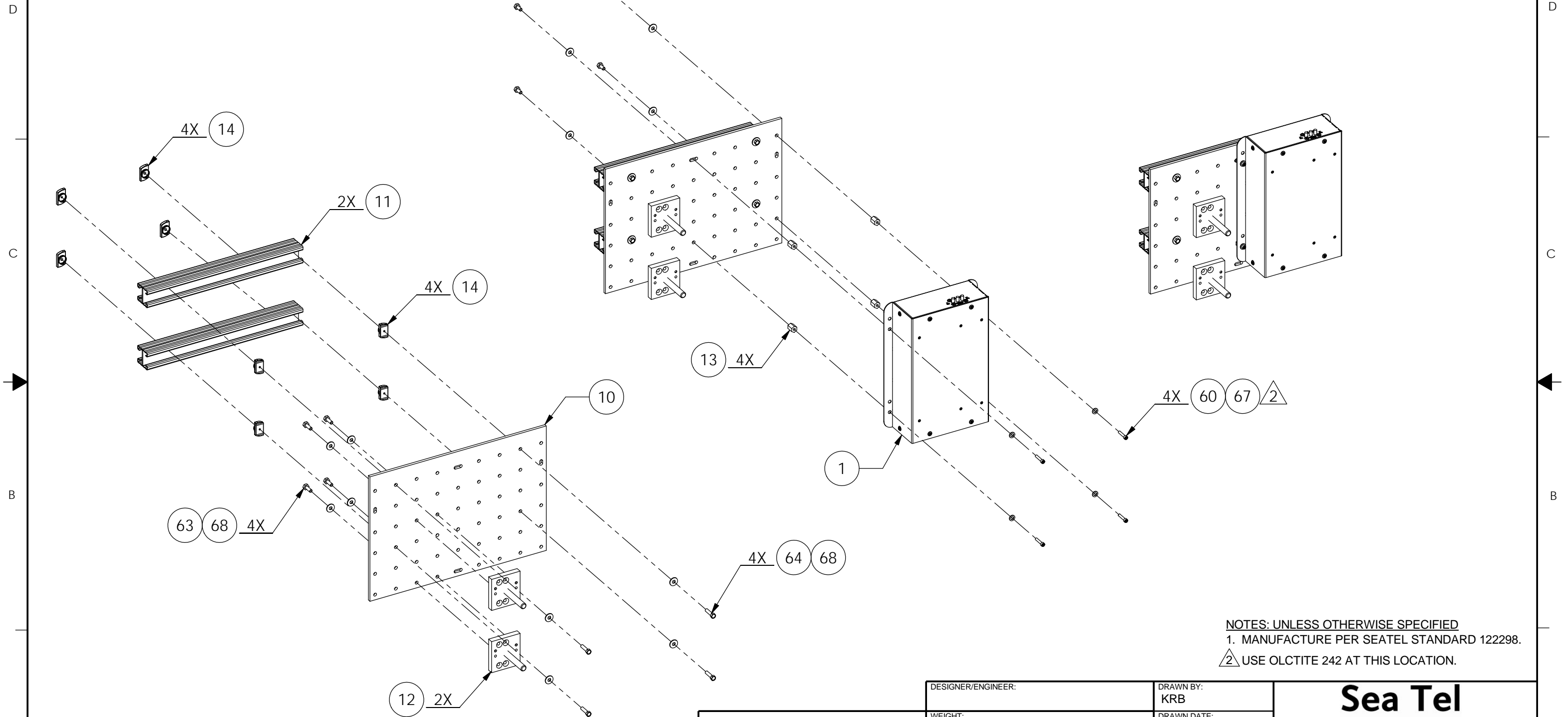


SINGLE LEVEL MFG BILL OF MATERIAL

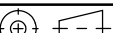
FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	131057-1	H	ENCLOSURE ASS'Y, PCU, 09G2, 3 CH, 232	
10	1 EA	123861	B	MOUNTING PLATE	
11	2 EA	126288-17	B	UNISTRUT, 1-5/8 H-CHANNEL, 17 IN, AL	
12	2 EA	127566-2	A2	MOUNTING BLOCK ASS'Y, COUNTER WEIGHT	
13	4 EA	124588-1021	A	STANDOFF, HEX, F/F, 1/4-20 X .50 OD X	
14	8 EA	126279-3	A4	NUT, 1 5/8 UNISTRUT, 1/4-20, W/SPRING	
60	4 EA	114593-202		SCREW, SOCKET HD, 1/4-20 x 3/8, S.S.	
62	4 EA	114586-536		SCREW, HEX HD, 1/4-20 x 5/8, S.S.	
63	4 EA	114586-537		SCREW, HEX HD, 1/4-20 x 3/4, S.S.	
64	4 EA	114586-538		SCREW, HEX HD, 1/4-20 x 1, S.S.	
67	4 EA	114580-027		WASHER, FLAT, 1/4, SMALL PATTERN, S.S	
68	12 EA	114580-029		WASHER, FLAT, 1/4, S.S.	

<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
MOUNTING ASS'Y, 6009-71/73, MK2, PCU				
PROD FAMILY COMMON	EFF. DATE 9/28/2012	SHT 1 OF 1	DRAWING NUMBER 132539	REV A1

REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	7398	07/12/10	RELEASED TO PRODUCTION WAS REVISION X2. RELOCATED ITEM 1 RELATIVE TO MOUNTING PLATE (ITEM 10).	KRB
A1	8525	5-19-11	UPDATE TITLE BLOCK & STANDARD NOTES	K.D.H.



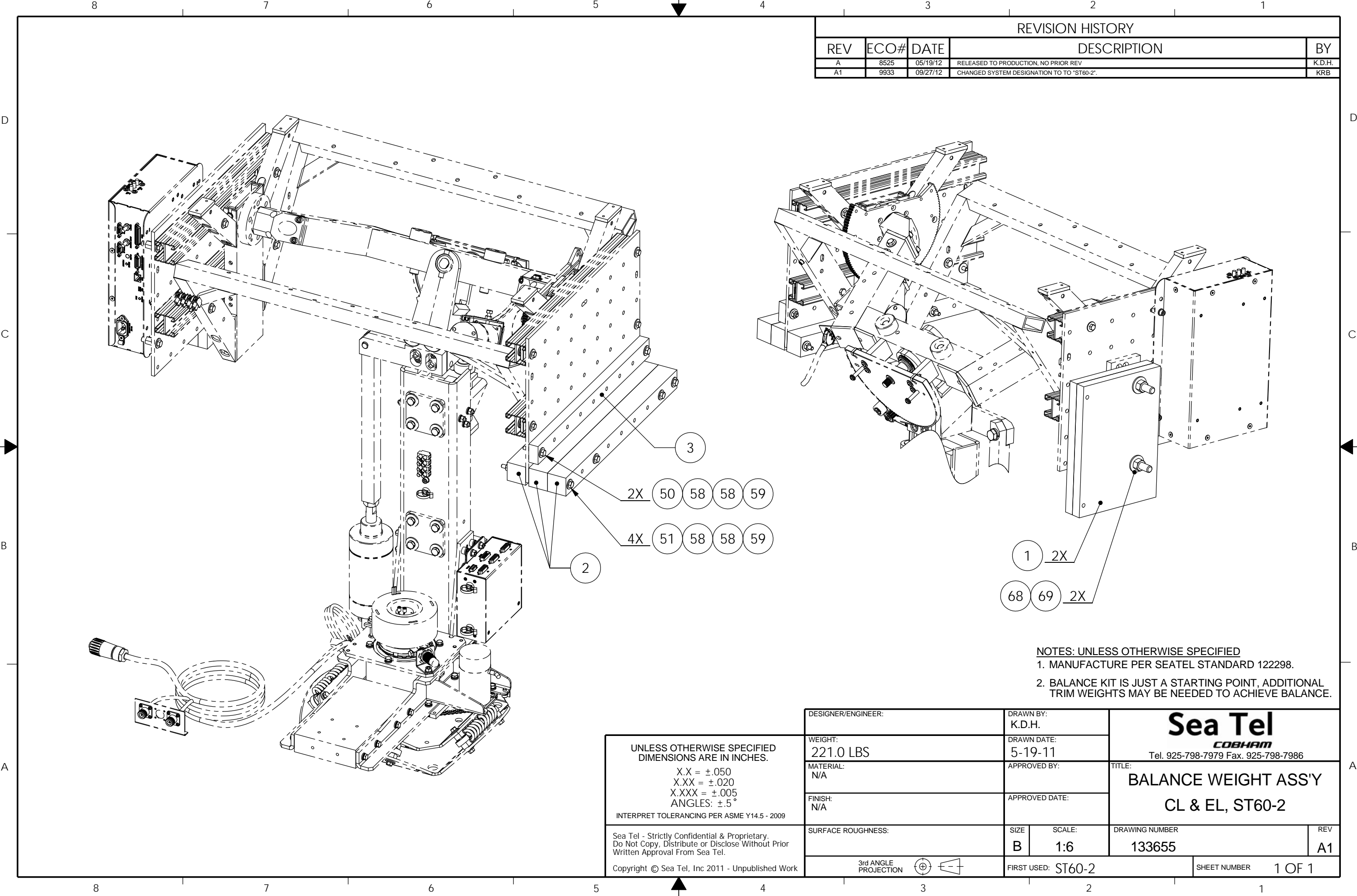
NOTES: UNLESS OTHERWISE SPECIFIED
1. MANUFACTURE PER SEATEL STANDARD 122298.
2 USE OLCTITE 242 AT THIS LOCATION.

<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.</p> <p>X.X = ± 0.050 X.XX = ± 0.020 X.XXX = ± 0.005 ANGLES: $\pm 5^\circ$</p> <p>INTERPRET TOLERANCING PER ASME Y14.5 - 2009</p>	DESIGNER/ENGINEER:	DRAWN BY: KRB		<h1>Sea Tel</h1> <p>COBHAM</p> <p>Tel. 925-798-7979 Fax. 925-798-7986</p>	
	WEIGHT: 16.366 LBS.	DRAWN DATE: 06/14/10			
	MATERIAL: N/A	APPROVED BY:		<p>TITLE:</p> <h2>MOUNTING ASS'Y, 6009-71/73, MK2, PCU</h2>	
	FINISH: N/A	APPROVED DATE:			
<p>Sea Tel - Strictly Confidential & Proprietary. Do Not Copy, Distribute or Disclose Without Prior Written Approval From Sea Tel.</p> <p>Copyright © Sea Tel, Inc 2011 - Unpublished Work</p>	SURFACE ROUGHNESS:	SIZE B	SCALE: 1:8	DRAWING NUMBER 132539	REV A1
	<p>3rd ANGLE PROJECTION</p> 		FIRST USED: 6009		SHEET NUMBER 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	2 EA	108724-1	C2	PLATE, COUNTER WEIGHT, 3/4 X 7-1/4 X	
2	3 EA	131374-2	A	WEIGHT, COUNTER, 1-1/2 X 1-1/2 X 17	
3	1 EA	131374-1	A	WEIGHT, COUNTER, 1-1/2 X 3/4 X 17	
50	2 EA	114586-541		SCREW, HEX HD, 1/4-20 x 1-1/2, S.S.	
51	4 EA	114586-554		SCREW, HEX HD, 1/4-20 x 5-1/2, S.S.	
58	12 EA	114580-029		WASHER, FLAT, 1/4, S.S.	
59	6 EA	114583-029		NUT, HEX, 1/4-20, S.S.	
68	2 EA	114580-033		WASHER, FLAT, 1/2, S.S.	
69	2 EA	114583-033		NUT, HEX, 1/2-13, S.S.	

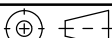
<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
BALANCE WEIGHT ASS'Y, CL & EL, ST60-2				
PROD FAMILY COMMON	EFF. DATE 9/28/2012	SHT 1 OF 1	DRAWING NUMBER 133655-1	REV A1



REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	8525	05/19/12	RELEASED TO PRODUCTION, NO PRIOR REV	K.D.H.
A1	9933	09/27/12	CHANGED SYSTEM DESIGNATION TO TO "ST60-2".	KRB

NOTES: UNLESS OTHERWISE SPECIFIED
1. MANUFACTURE PER SEATEL STANDARD 122298.
2. BALANCE KIT IS JUST A STARTING POINT, ADDITIONAL TRIM WEIGHTS MAY BE NEEDED TO ACHIEVE BALANCE.

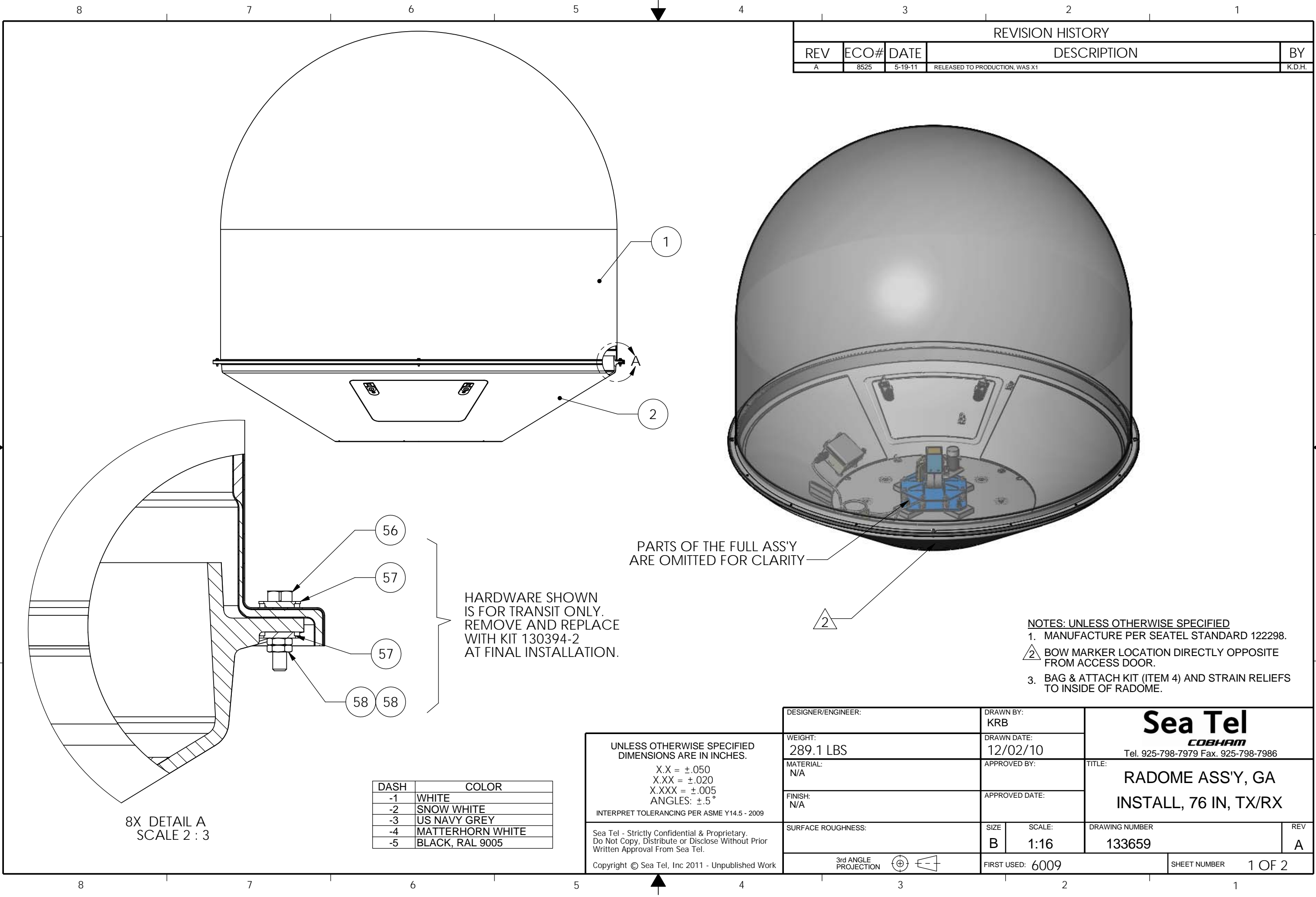
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
X.X = ±.050
X.XX = ±.020
X.XXX = ±.005
ANGLES: ±.5°
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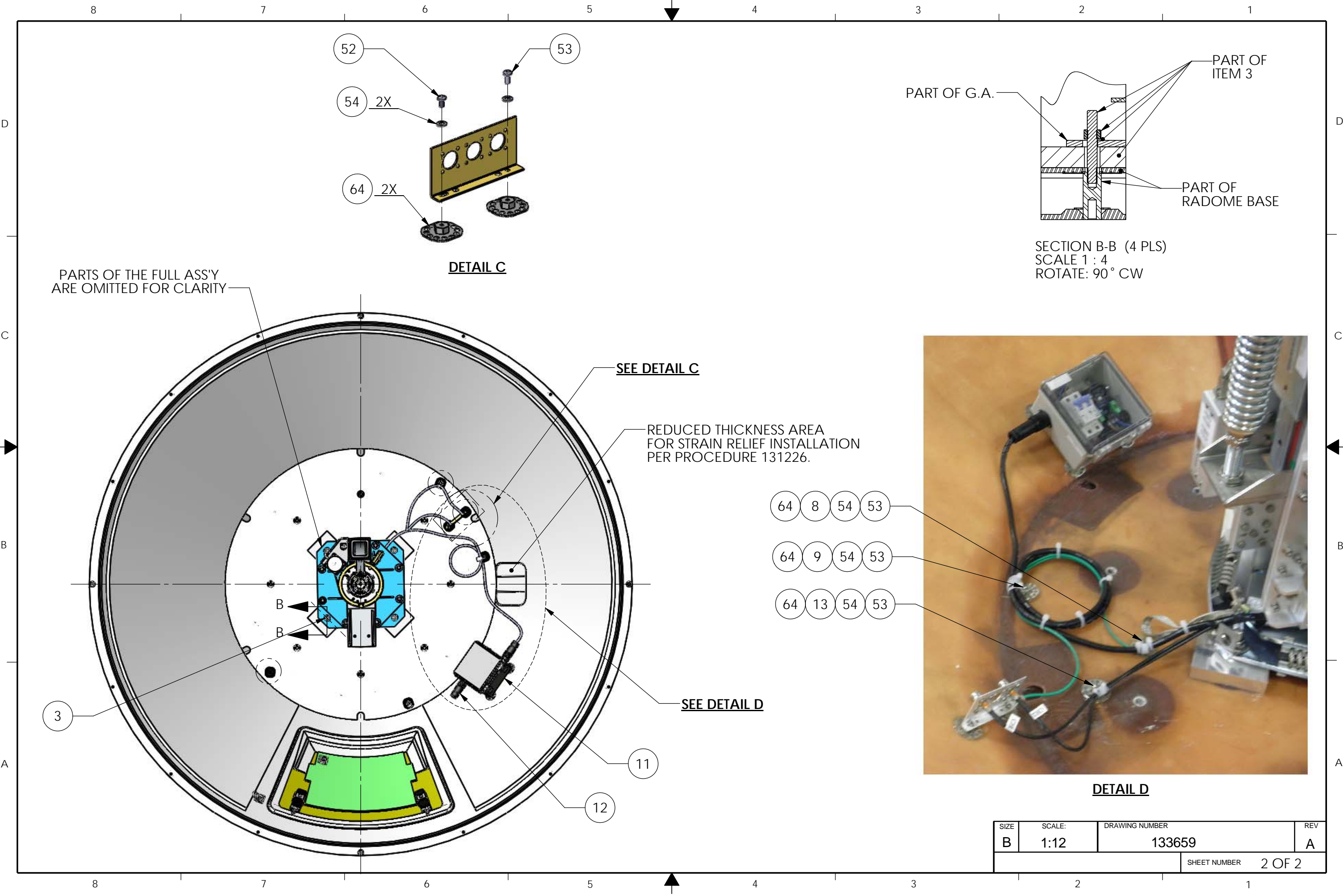
DESIGNER/ENGINEER:		DRAWN BY: K.D.H.		<div>Sea Tel</div> <div>COBHAM</div> <div>Tel. 925-798-7979 Fax. 925-798-7986</div> <div>TITLE: BALANCE WEIGHT ASS'Y CL & EL, ST60-2</div>	
WEIGHT: 221.0 LBS		DRAWN DATE: 5-19-11			
MATERIAL: N/A		APPROVED BY:			
FINISH: N/A		APPROVED DATE:			
SURFACE ROUGHNESS:		SIZE B	SCALE: 1:6	DRAWING NUMBER 133655	REV A1
3rd ANGLE PROJECTION 		FIRST USED: ST60-2			SHEET NUMBER 1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

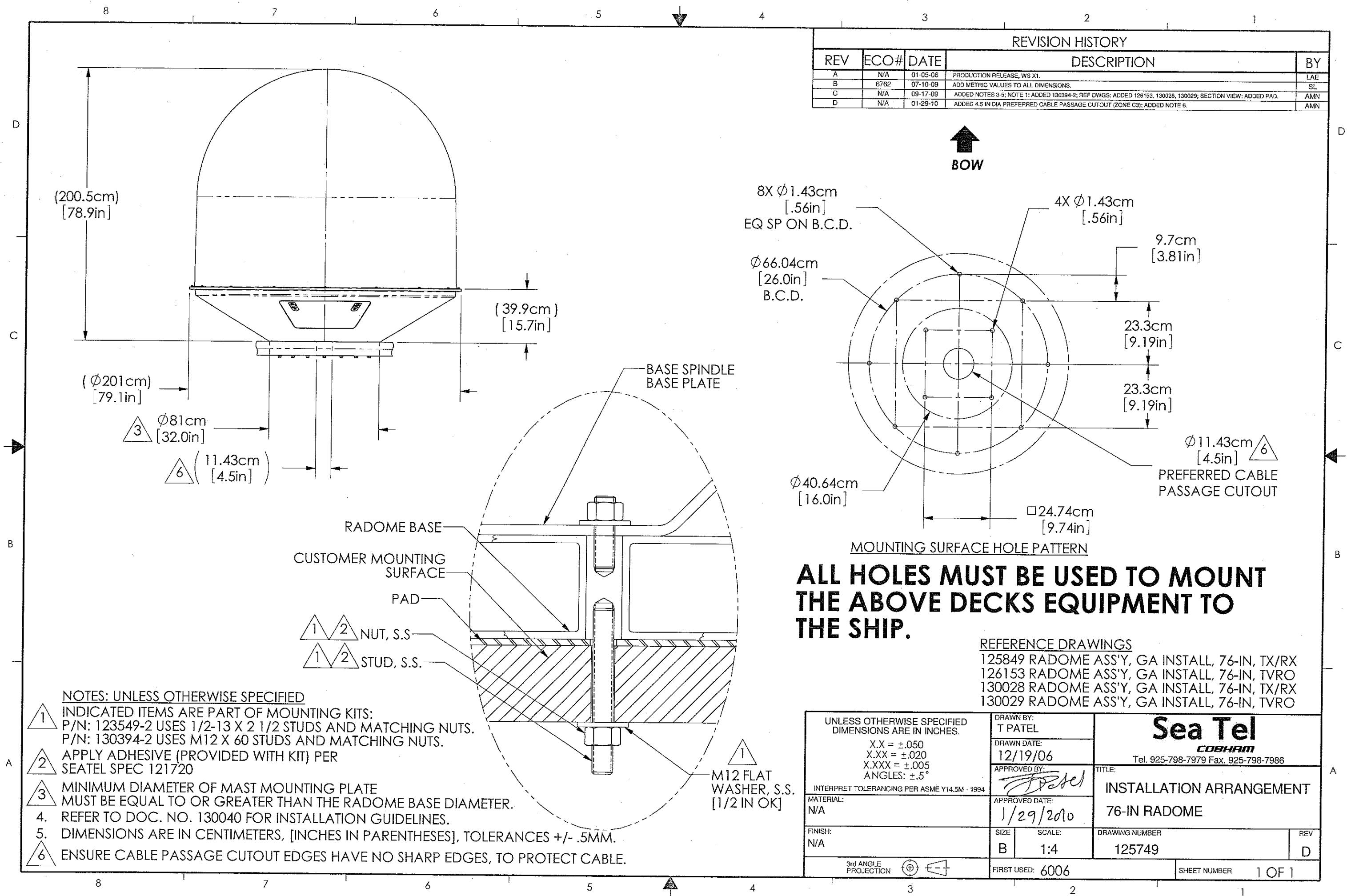
FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	128652-1	A2	RADOME TOP FAB, 76 IN, WHITE	
2	1 EA	130395-1	A3	RADOME BASE ASS'Y, 76 IN, WHITE	
3	1 EA	130390-2	B	KIT, HARDWARE, GA TO RADOME, RAISED	
4	1 EA	130394-2	D	KIT, HARDWARE, RADOME TO MAST, 12-HOL	(NOT SHOWN) ,
6	11 EA	119801-019	B	CABLE TIE, NYLON, 7.5 IN, NATURAL	
7	1 OZ	125948-1	A	ADHESIVE, HOT MELT, 3M SCOTCH-WELD 37	(NOT SHOWN) ,
8	1 EA	111679-7	B	CABLE CLAMP, NYLON, .50 DIA, #8 MTG H	
9	1 EA	111679-25	B	CABLE CLAMP, NYLON, 3/4 DIA, #10 MTG	
10	3 EA	124903-1	B3	STRAIN RELIEF ASS'Y (CABLE GLAND)	(NOT SHOWN) ,
11	1 EA	132956-1	D	CIRCUIT BREAKER BOX ASS'Y, 6 AMP	
12	1 EA	122360-3	B1	CONN, CIR, C16 FEMALE, 3+PE, C016 20D	
13	1 EA	111679-5	B	CABLE CLAMP, NYLON, .375 DIA, #8 MTG	
52	1 EA	119745-216		SCREW, PAN HD, PHIL, M4 X 6, S.S.	
53	4 EA	119745-218		SCREW, PAN HD, PHIL, M4 x 8	
54	5 EA	114580-230		WASHER, FLAT, M4, S.S.	
56	8 EA	130451-222	A	SCREW, HEX HD, M6 X 35, 316 SS	
57	16 EA	130371-170	A	WASHER, NYLON, 6.4 ID, 12 OD	
58	16 EA	120089-251		NUT, HEX, M6, S.S.	
64	5 EA	125806-7	A	ROTALOC HEX NUT, SS-1-B38-M4 X 07-6H	

				
RADOME ASS'Y, GA INSTALL, 76 IN, WHITE				
PROD FAMILY COMMON	EFF. DATE 9/28/2012	SHT 1 OF 1	DRAWING NUMBER 133659-1	REV A





REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	N/A	01-05-06	PRODUCTION RELEASE, WS X1.	LAE
B	6762	07-10-09	ADD METRIC VALUES TO ALL DIMENSIONS.	SL
C	N/A	09-17-09	ADDED NOTES 3-5; NOTE 1: ADDED 130394-2; REF DWGS: ADDED 126153, 130028, 130029; SECTION VIEW: ADDED PAD.	AMN
D	N/A	01-29-10	ADDED 4.5 IN DIA PREFERRED CABLE PASSAGE CUTOUT (ZONE C3); ADDED NOTE 6.	AMN



- NOTES: UNLESS OTHERWISE SPECIFIED**
- 1 INDICATED ITEMS ARE PART OF MOUNTING KITS:
P/N: 123549-2 USES 1/2-13 X 2 1/2 STUDS AND MATCHING NUTS.
P/N: 130394-2 USES M12 X 60 STUDS AND MATCHING NUTS.
 - 2 APPLY ADHESIVE (PROVIDED WITH KIT) PER SEATEL SPEC 121720
 - 3 MINIMUM DIAMETER OF MAST MOUNTING PLATE MUST BE EQUAL TO OR GREATER THAN THE RADOME BASE DIAMETER.
 - 4. REFER TO DOC. NO. 130040 FOR INSTALLATION GUIDELINES.
 - 5. DIMENSIONS ARE IN CENTIMETERS, [INCHES IN PARENTHESES], TOLERANCES +/- .5MM.
 - 6 ENSURE CABLE PASSAGE CUTOUT EDGES HAVE NO SHARP EDGES, TO PROTECT CABLE.

REFERENCE DRAWINGS
 125849 RADOME ASS'Y, GA INSTALL, 76-IN, TX/RX
 126153 RADOME ASS'Y, GA INSTALL, 76-IN, TVRO
 130028 RADOME ASS'Y, GA INSTALL, 76-IN, TX/RX
 130029 RADOME ASS'Y, GA INSTALL, 76-IN, TVRO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES.		DRAWN BY: T PATEL		Sea Tel COBHAM Tel. 925-798-7979 Fax. 925-798-7986	
X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5°		DRAWN DATE: 12/19/06			
INTERPRET TOLERANCING PER ASME Y14.5M - 1994		APPROVED BY: <i>[Signature]</i>		TITLE: INSTALLATION ARRANGEMENT	
MATERIAL: N/A		APPROVED DATE: 1/29/2010		76-IN RADOME	
FINISH: N/A		SIZE: B	SCALE: 1:4	DRAWING NUMBER: 125749	REV: D
3rd ANGLE PROJECTION			FIRST USED: 6006	SHEET NUMBER 1 OF 1	

Procedure, Radome Strain Relief Installation

- 1.0 Purpose.** To define the installation procedure for installing strain reliefs in "smooth base" radomes.
- 2.0 Scope.** This installation procedure applies to fiberglass radomes having Sea Tel's standard four-hole mounting pattern, and M12 mounting hardware, in the 80-180 cm (34-66 in) nominal size range, typically referred to as "smooth" base radomes. It also applies to our larger 193 cm (76-inch) radome having a twelve-hole mounting pattern. It is to be used where the preferred center cable exit may not be desired.
- 3.0 Tools/materials.**
1. Electric drill.
 2. Small drill bit 1/8" dia. (3-4mm dia.).
 3. Hole saw, 1 3/8" dia. (35 mm), with mandrel and 1/4" dia. pilot drill.
 4. Medium file.
 5. Two 1-1/2" (38 mm) adjustable pliers.
 6. #2 Phillips screwdriver.
 7. Fiberglass resin & catalyst, (marine grade) - at least 2 oz (50 cc).
Such as Tap Plastics Marine Vinyl Ester Resin with MEKP Catalyst.
Note: Use liquid resin, instead of paste type, due to better penetration.
 8. Mixing cup – 4 oz (100 cc).
 9. Disposable brush.
 10. Strain Relief Assembly 124903-1, (one per cable).
- 4.0 Responsibilities.** It is the responsibility of the installer to observe all standard safety precautions, including eye, slip, and chemical protection when performing this procedure.

4.1 Procedure.

Remove the standard cable pass through assembly 130818-1*

* N/A for 193 cm (76-inch) nominal size radomes. Refer to Fig 1, then use #2 Phillips screwdriver to remove 4 ea. attachment screws.

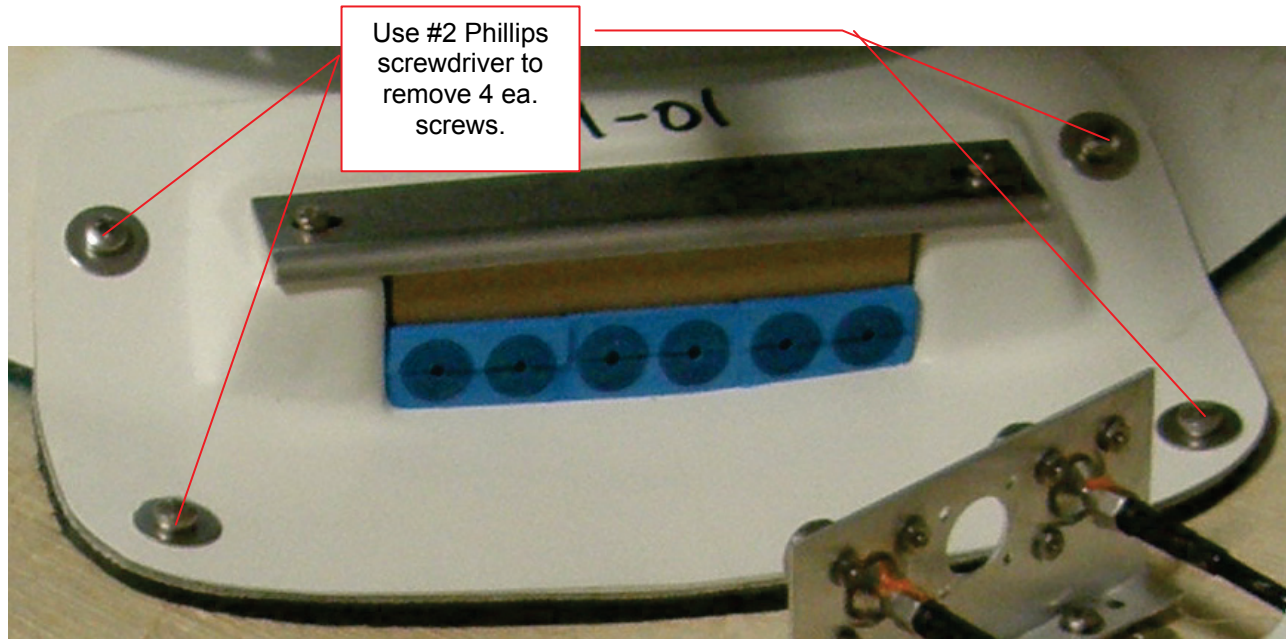


Fig. 1 – Cable pass-thru assembly

Procedure, Radome Strain Relief Installation

4.2 Making the holes

PLANNING: Space has been allowed for up to 5 ea. strain reliefs, but, install only as many as needed. (Typically only 2-3 for TX/RX systems). Refer to Fig 2 then plan which hole positions to use.

For 76-inch radomes lowest holes may be approx 1.5 inches from inside wall corner with floor (ref drawing 129416).

Note: The hole center-to-center distance given is the MINIMUM.

Follow good engineering practice and provide the largest spacing possible between holes as follows:

- 1 Hole pattern - "A".
- 2 Hole pattern - "B", "C".
- 3 Hole pattern - "A", "B", "C", ("A", "D", "E" PERMITTED).
- 4 Hole pattern - "B", "C", "D", "E".
- 5 Hole pattern - "A", "B", "C", "D", "E".

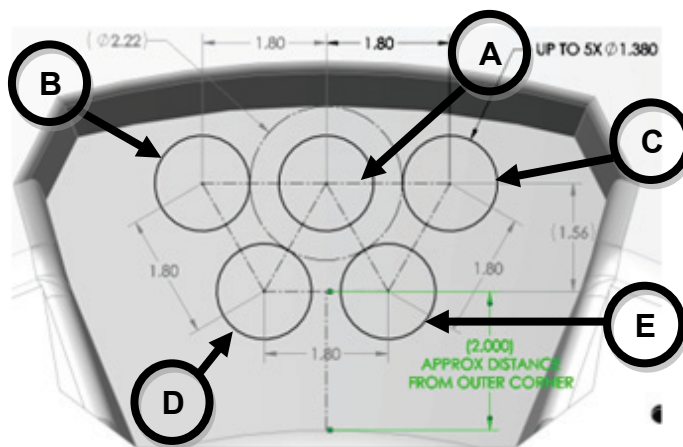


Fig. 2 – Planning
Measure in place or use
template drawing 132234



Fig. 3 – (Up to) 5-Hole Pattern

Procedure, Radome Strain Relief Installation

4.3 Measure, mark and drill pilot holes

CAUTION: The hole locations cannot be determined accurately from outside of the radome.

Using full scale drawing 132234, provided in the strain relief kit, measure mark and drill pilot holes from the inside out, and using only light pressure, use the small drill bit, (~1/8" dia) to make a pilot hole through each planned location.

4.4 Use the hole saw from the outside with light pressure.

CAUTION: Using the hole saw from the inside is likely to damage the Gel Coat.

CAUTION: Heavy pressure on the hole saw from the inside is likely to damage the Gel Coat and splinter the fiberglass.

Working from the outside, use a 1-3/8" hole saw to make the holes for the planned strain reliefs.

4.5 After holes are drilled CAREFULLY use a file to clean the hole edges.

4.6 Test fit the strain reliefs in each location, then, make adjustments as necessary.

4.7 Sealing the hole edges.

CAUTION: Cut edges can allow water and/or ice ingress and weaken the fiberglass laminate or structural foam. It is essential to seal all cut edges thoroughly with fiberglass resin to preserve the radome's structural strength.

CAUTION: Fiberglass paste or RTV silicone sealant will not wick into and seal the fiberglass strands as well as fiberglass resin, ONLY use fiberglass resin (such as TAP PLASTICS MARINE VINYL ESTER, or equivalent) for sealing the cut edges.

Follow the manufacturer's instructions to mix a small amount of fiberglass resin and catalyst, then working quickly, use a disposable brush to apply mixed fiberglass resin to the hole edges, both inside and out.

Allow the fiberglass resin to set per resin manufacturer's instructions.

Note: Like all chemical reactions, set time will be temperature/humidity dependent.

4.8 Refer to strain relief assembly drawing 124903

Being careful not to damage either the radome or the strain relief threads, use adjustable pliers to install strain reliefs.



Fig. 4 – Outside view.

Procedure, Radome Strain Relief Installation



Fig. 5 – Outside view.

4.9 Rotate General Assembly (G.A.)

Once cables have been installed, rotate General Assembly (G.A.), to ensure cables are routed properly and do not interfere with azimuth rotation.



Fig. 6 – Inside view.

5.0 Records. N/A.

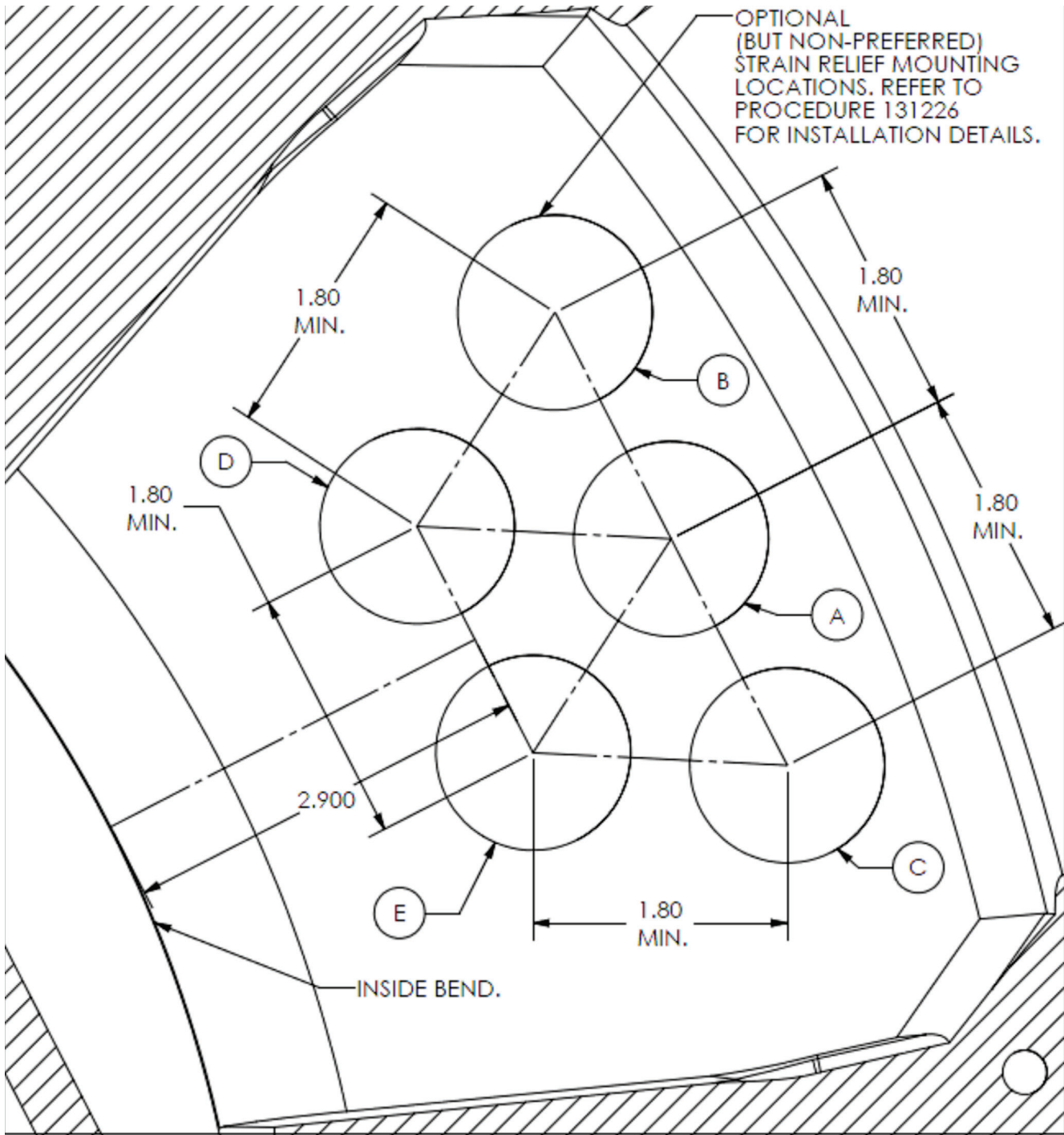
6.0 Training. N/A

7.0 References.

Strain relief assembly drawing (P/N: 124903)
Template drawing (P/N 132234)

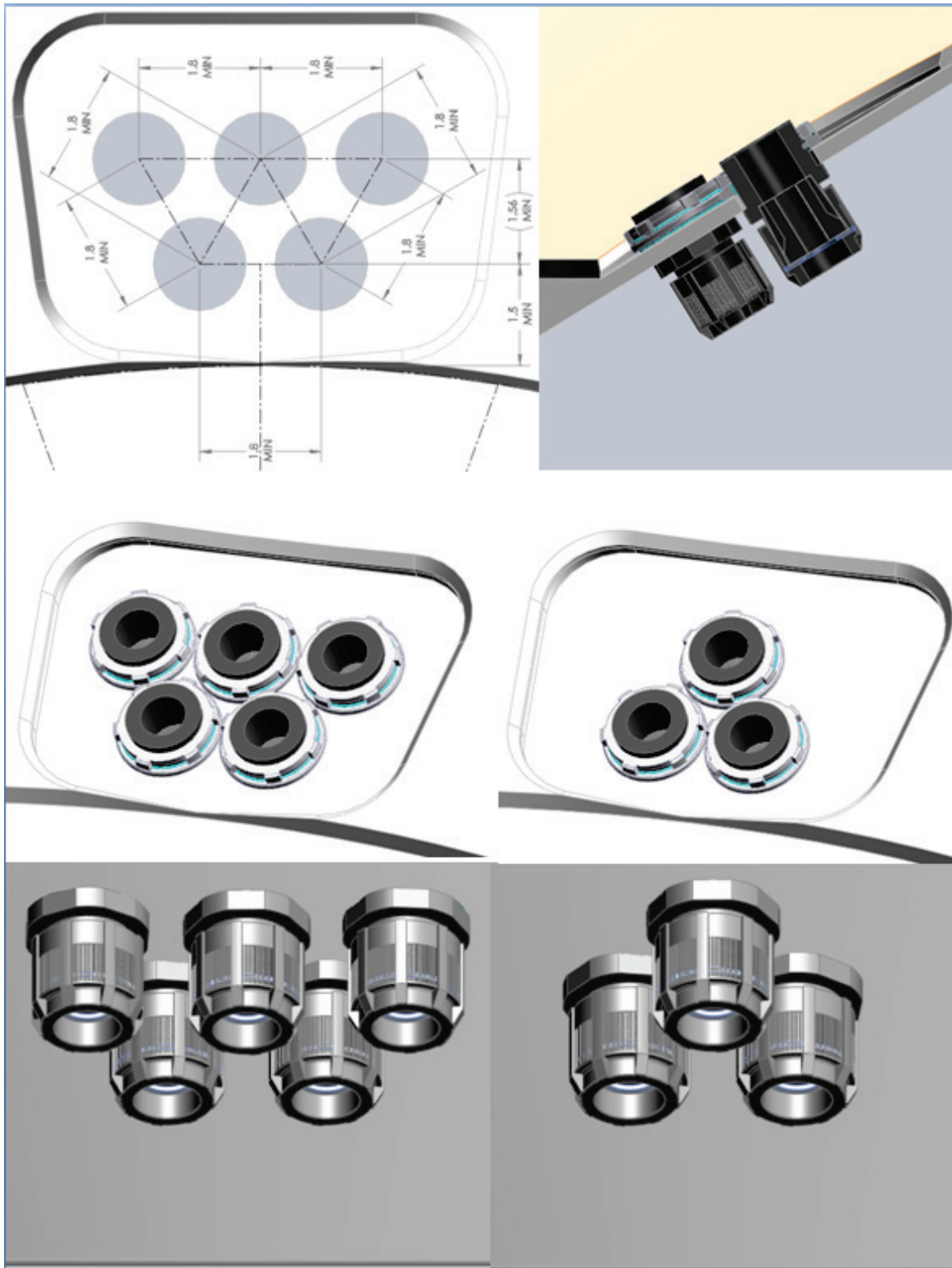
Procedure, Radome Strain Relief Installation

8.0 Strain relief positioning for 80-180 cm (34-66 in) smooth based radomes, (May use Sea Tel drawing 132234 as template.)



Procedure, Radome Strain Relief Installation

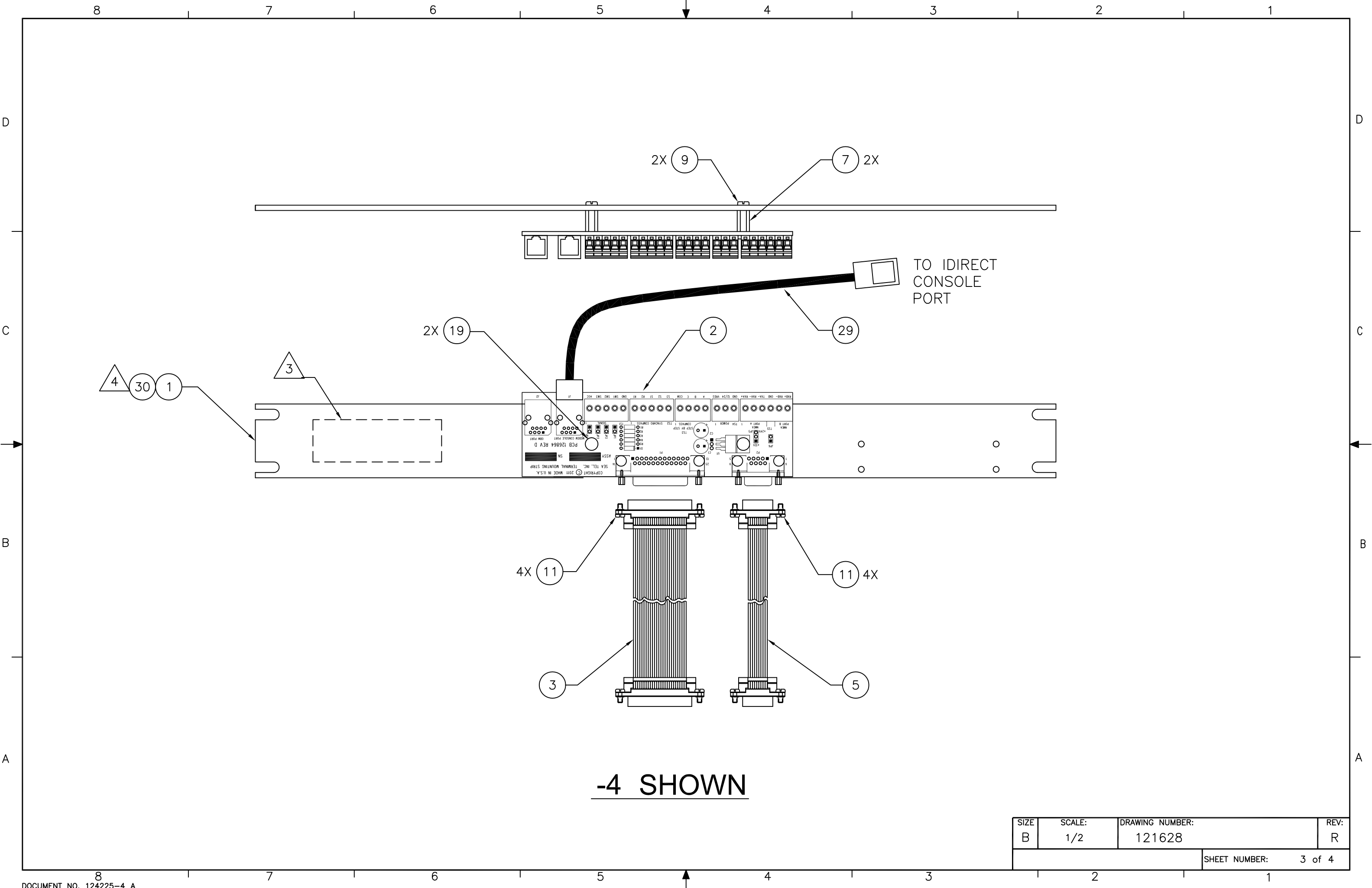
9.0 Strain relief positioning for 193 cm (76-inch) radomes. (May use Sea Tel drawing 132234 as template.)



SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	112657	E	MACHINING, TERMINAL MOUNTING STRIP	
2	1 EA	126865-2	G	PCB ASS'Y, TERMINAL MOUNTING STRIP, 5	
3	1 EA	112936-36	D1	CABLE ASS'Y, D-SUB, 25 PIN, 36 IN	
5	1 EA	116669-36	B1	CABLE ASS'Y, D-SUB, 9-PIN, 36 IN.	
7	2 EA	121228-3072		STANDOFF, HEX, F/F, 6-32 X .25 OD X .	
9	2 EA	114588-146		SCREW, PAN HD, PHIL, 6-32 x 3/8, S.S.	
11	8 EA	114588-107		SCREW, PAN HD, PHIL, 4-40 x 5/16, S.S	
19	2 EA	114588-144		SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S.	
29	1 EA	119478-5	D	CABLE ASS'Y, RJ-45 SERIAL, 60 IN.	
30	1 EA	126877	B2	HARNESS ASS'Y, COMTECH MODEM INTERFAC	

<div> <div>Sea Tel</div> <div>COBHAM</div> </div>				
ASSEMBLY, TERMINAL MOUNTING STRIP				
PROD FAMILY COMMON	EFF. DATE 9/9/2011	SHT 1 OF 1	DRAWING NUMBER 121628-4	REV R



-4 SHOWN

SIZE B	SCALE: 1/2	DRAWING NUMBER: 121628	REV: R
SHEET NUMBER:			3 of 4

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	116880	G	PANEL MACHINING, RACK, BASE MUX	
2	1 EA	129613-2	E	MODEM ASS'Y, 400MHZ FSK, 3 CH, BDE, R	
3	1 EA	116388	D	BRACKET, CONNECTOR	
4	1 EA	115492-1	C5	ADAPTER, N(F)-SMA(F), W/FLANGE	
5	8 EA	114588-107		SCREW, PAN HD, PHIL, 4-40 x 5/16, S.S	
6	8 EA	114583-005		NUT, HEX, 4-40, S.S.	
7	2 EA	114588-144		SCREW, PAN HD, PHIL, 6-32 x 1/4, S.S.	
8	6 EA	114580-007		WASHER, FLAT, #6, S.S.	
9	1 EA	110567-19	C1	ADAPTER, N(F)-N(F), STRAIGHT, FLANGE	
11	1 EA	113303-10	V	CABLE ASS'Y, SMA 90 - SMA (M), 9 IN	
12	8 EA	114580-005		WASHER, FLAT, #4, S.S.	
13	4 EA	114588-145		SCREW, PAN HD, PHIL, 6-32 x 5/16, S.S	

Sea Tel
COBHAM

BASE MUX RACK PANEL ASS'Y, 400MHZ, RS-232

PROD FAMILY COMMON	EFF. DATE 9/9/2011	SHT 1 OF 1	DRAWING NUMBER 129710-1	REV B2
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